

WIRED

UK EDITION

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KEY TECH
TRENDS

YOU
ARE A
GENIUS

Killing the
myth of
creativity

+

The fugitive
CEO taking
on WhatsApp

+

How a war
general can
save your
business

MAR 15
WIRED.CO.UK

PUSSY RIOT BREAK EVERY RULE

THE WIRED RULE 22-page
special
BREAKERS' GUIDE



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COFFEE

Like a car. But be



Fuel consumption figures mpg (litres/100km) and CO₂ emissions (g/km), Audi A3 Sportback e-tron: Urban: N/A, Extra Urban: N/A, calculated from two test results: one when the battery is fully charged and the other when the battery is discharged. The two test results Extended range achieved by 1.4 TFSI petrol engine generating electricity. Standard EU Laboratory Test figures are for comparative

Audi
Vorsprung durch Technik



What Car? Electric Car of the Year 2015.

The A3 Sportback e-tron is the first of our plug-in hybrid cars. Unlike other hybrids where a lot of effort has been made to make the car look different, e-tron has been designed to make a difference. On the one hand, it can deliver up to 176.6mpg and only emit 37g/km of CO₂. On the other, it will deliver all the performance you'd expect from an Audi. In fact, What Car? have already named it Electric Car of the Year 2015, so the judges seem to agree that the A3 Sportback e-tron is indeed like a car, but better.

The new Audi A3 Sportback e-tron.

etter



WHATCAR?
**Car of the
Year 2015**
Best electric car

Combined/weighted: 176.6 mpg (1.6 litre/100km). CO₂ emissions: 37g/km. The 'Combined/weighted' fuel consumption CO₂ figures are a weighted average, taking into account mileage range on battery power only, providing a figure in a variety of charge conditions. purposes between vehicles and may not reflect real driving results. Images for illustration purposes.

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RUE DU RHONE

WHERE TIME BEGINS



OFFICIAL TIMING PARTNER



EE
BRITISH ACADEMY
FILM AWARDS



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THE RULE BREAKERS: **Pussy Riot**

The provocative balaclava-clad feminists reveal their plans for the future of protesting

TOP: MUSICIAN
MATVEY KULALOV
BELOW TOP:
MARIA ALYOKHINA,
NADELZHA ANDREYEVNA
TOLOKONNIKOVA
CENTRE: ACTIVIST
PYOTR VERZILOV
BOTTOM: MUSICIAN
SASHA KLOKOVA





FROM MICHAEL MANN DIRECTOR OF HEAT, COLLATERAL AND THE INSIDER

CHRIS HEMSWORTH

blackhat

YOU ARE NO LONGER IN CONTROL

LEGENDARY PICTURES AND UNIVERSAL PICTURES PRESENT A LEGENDARY PICTURES/FORWARD PASS PRODUCTION A MICHAEL MANN FILM
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STORY BY MICHAEL MANN AND MORGAN DAVIS FOEHL SCREENPLAY BY MORGAN DAVIS FOEHL AND MICHAEL MANN
DIRECTED BY MICHAEL MANN



IN CINEMAS FEBRUARY 20



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START

Lapland has liftoff

Karin Nilsdotter has big plans for Kiruna – an Arctic Circle town she says is the perfect location for a European spaceport

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START

Inside the lives of microbes

Want to see some of the world's smallest creatures? Get up close and personal at a recently opened Amsterdam museum

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GEAR

Ensure Rover returns

WIRED takes four discrete pet-trackers for walkies to see which one will help you keep tabs on your beloved pooch or pussycat

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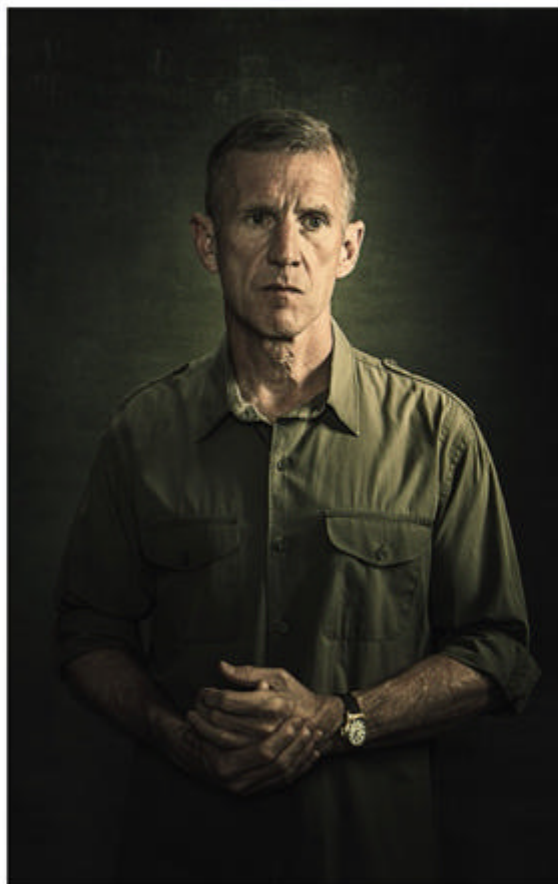
IDEAS BANK

Brain food and provocations

Maelle Gavet says Google and Facebook need regulating. Plus: Wendy Hall; Charlie Burton; David Gelles; Christopher Stevens



PHOTOGRAPHY: CHRIS CRISMAN; JAY BROOKS. ILLUSTRATION: MIKE MCQUADE



Clockwise from above: Stanley McChrystal, a former general bringing battlefield know-how to business; you already have the brain of a genius; Karin Nilsdotter – spaceport planner

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Opera's scene-change

La Scala, the temple of Italian opera, is embracing tech to reach new audiences. WIRED takes a peek behind the scenes

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Do the robot

An array of mechanical limbs collaborate to create art – from tap-dancing out a tune to a ballet composed of robotic arms and legs

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Life enhancement

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From drone journalists to the exiled creator of Russia's Facebook, WIRED introduces other disrupters of note

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The new art of business

General Stanley McChrystal led a new kind of warfare to take on Al-Qaeda. He's now heading to the corporate battlefield

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Microsoft's latest idea: augmented-reality goggles that can seamlessly merge the physical world with virtual reality



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At the heart of the image



CONTRIBUTORS

MAKING WIRED

When Platon met Pussy Riot

This month's cover stars, Maria Alyokhina and Nadezhda Andreyevna Tolokonnikova – members of Russian activist group Pussy Riot – were captured by photographer Platon. So what did he make of these rebel icons?

“My relationship with Russia has been fundamental to my life's journey as a photographer and human rights activist. Having photographed Putin and Medvedev both as presidents, I returned to Russia with Human Rights Watch and my foundation, The People's Portfolio, to photograph the emergence of civil society in Russia under Putin. It was through this process that I was privileged to meet and interact with some of the most courageous people on the planet – people who believe in freedom of speech and respect for the dignity of the individual. My next connection with Russia was to return under great secrecy with the US edition of WIRED to photograph Edward Snowden. It took nearly a year to negotiate and, once again, I was exposed to the fundamental questions of our time: what is right and wrong? What is fair and just?”

“Through this whole period I had watched Pussy Riot make a giant imprint on the world. They have proved not just to be cultural icons, but also to be effective contemporary activists with a capacity to inspire the next generation – so I was thrilled to photograph Pussy Riot in my New York studio. There are moments of defiance and a punk rock attitude, standing in the face of oppression, but there are also moments of great style and panache. What makes Pussy Riot so powerful in today's society is their compassion and empathy for people's human and civil rights, so I also wanted to portray a sense of tenderness and humanity. These activists are the real deal and it was imperative not to show them as merely a two-dimensional media-made cartoon. They are epic humanitarians and I am honoured to know them.”



Clockwise, from above left: Studio Platon plays host to members of Pussy Riot; Platon talks politics with Maria Alyokhina; Nadezhda Andreyevna Tolokonnikova sits for Platon; WIRED's creative director discusses the shoot



GREG WILLIAMS

WIRED's deputy editor meets Pussy Riot this month, to ask how the infamous activists manage to stay in the spotlight – and remain relevant. “They're determined and bold, but there's also a sense of fun about them,” he says. “As serious as they are about changing the system in Russia, they retain a sharp sense of humour. Their protests and performances will continue, but they have even bigger ambitions.”



WENDY HALL

A professor at the University of Southampton and a founding member of the Web Science Trust, Hall writes in Ideas Bank that we, the users, must ensure the internet remains open and free. “As Edward Snowden's revelations about the NSA have proved, governments are preoccupied with what citizens are getting up to on the internet,” she says. “And with the fact they have so little control over either.”

OFF-PAGE

WIRED.CO.UK

All innovations lead to Wonka

"Remember Wonkavision (Nasa just emailed a wrench to space, wired.co.uk)? What was complete and total make-believe just 40 years ago can now actually come true. We may not be sending Oompa Loompas to space, but it might not be long before we are able to send meals – just change the printer material to edible proteins and complex sugars, and with the blink of an eye Wonkavision goes from fiction to reality." **Steve Yuhas, via wired.co.uk**

WIRED.CO.UK RE: HANDS-ON WITH LG'S CURVED PHONE

"Curved smartphone? No big deal, the iPhone 6 was first. Not when you buy it, but it is after a short time in your pocket" **Greg Ford**

PRINT

Please mind your head

"*Headspace* is a good app for getting started, but I'm a huge proponent of learning how to meditate without any external aids (Zen on your smartphone, 01.15). You won't always have access to a guided meditation in the real world, so why limit yourself? Things like this can be a barrier to meditating and an excuse not to." **Chelsea Leger, via wired.co.uk**

EVENTS

Complex betting strategy

"I have a bet with Neil Turok that gravitational waves are at least five per cent of the density perturbations. If this is confirmed by future observations, it will be quantum gravity written across the sky. Even better, I will win \$200." **Stephen Hawking at WIRED/BAFTA's screening of *The History of Everything***

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But does it go ping?

"The EmDrive is basically a microwave oven powered by good old-fashioned electricity (Nasa validates 'impossible' space drive, wired.co.uk). What the inventor is saying is that he can get a microwave oven to move. If the resonant cavity is indeed completely closed (so that the microwaves could not escape), the insides would heat up (just as in any old microwave oven). Hot objects radiate thermally in the infrared spectrum. Unless the device is perfectly symmetrical in terms of its thermal radiation profile, the asymmetrical thermal radiation pattern will produce a small amount of thrust." **Barry Kort, via wired.co.uk**

Want to air your views on WIRED?
Get in touch:
rants@wired.co.uk



Undo Apologies to Linda Liukas and Fleur de Force for the pictorial mix-up in our WIRED Next Generation coverage in 01.15

Thanks to Caroline Sim for Rachel Wingfield's hair and make-up in 02.15

PRINT

Heat exchange

"Power stored in compressed air tanks is an absolutely terrible idea (Green machine, *above*, 01.15). Compressed air is one of the most inefficient ways to store energy even with heat exchangers. When you have to deal with the dangers of high-pressure air at 3,000psi, failures become rockets or bombs." **Jerry Biehler, via wired.co.uk**

LightSail Energy founder Danielle Fong replies: "The danger and flammability of gasoline vastly exceeds that of compressed air. Gas engines also have lower efficiency. The critical reason they are dominant is because of cost; it is much cheaper to power it with an engine than any other method. Our objective is to produce a lower-cost system by being efficient enough, vastly lower cost and longer-lasting than competing systems. And it is going well." **Via wired.co.uk**



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FROM THE EDITOR

We love pirates at WIRED – not the Somali buccaneer types, but the freethinking entrepreneurs and creative troublemakers who refuse to accept conventional wisdom. They tend to ask for forgiveness rather than permission – look at how Uber and Airbnb are scaling despite their regulatory impediments. They take a contrarian approach to business, typically answering Peter Thiel’s question, “What valuable company is nobody building?” And they don’t let anyone constrain their thinking, whether they’re 3D-printing couture dresses or recording albums on to DNA.

This month, we celebrate the rule breakers in all their diversity – the entrepreneurs growing meat in a lab, turning cars into aircraft, using drones to defy government censorship and using their own bodies to test their medical theories. Some of our stories are about entrepreneurs: Pavel Durov, who created Russia’s version of Facebook, broke the rules in a literal way when he refused to bow to Kremlin censorship and had to flee Moscow rather swiftly. Now exiled, he’s building a new kind of messaging app called *Telegram* that he insists is faster and more secure than the ones you are probably using. But we are also celebrating cultural rule breakers whose strength of character we find inspiring – such as Pussy Riot, brave young musicians who have taken great personal risks to showcase the repression facing free-thinkers in today’s Russia.

Sometimes our inspiration for a WIRED story comes unexpectedly. As I was preparing to leave the TED conference in Vancouver last March, I got pulled into a conversation with a strategy adviser named William Charnock in which Stanley McChrystal’s name came up. I knew McChrystal



Pavel Durov was dismissed from VKontakte and went into exile from Russia after refusing to comply to state demands

as the retired US Army general who had helped lead the asymmetric war against Al-Qaeda and the Taliban in Iraq and Afghanistan. What I didn’t know was that he was now transferring his skills to the business world – helping executives confront today’s battlefield of lean-startup competitors and digital insurgents.

We’re currently accepting applications for WIRED 2015 Innovation Fellows – 12 emerging stars we’ll be mentoring and introducing on stage at WIRED2015 in October. This year we’re partnering with The Space to give away £100,000 to three additional Creative Fellows to make digital art. Find out more and apply: wired.co.uk/fellows.

PHOTOGRAPHY: SAM BARKER

DMA MAGAZINE OF THE YEAR 2014 • DMA TECHNOLOGY MAGAZINE OF THE YEAR 2014 • BSME ART DIRECTOR OF THE YEAR, CONSUMER 2013 • PPA MEDIA BRAND OF THE YEAR, CONSUMER 2013 • DMA TECHNOLOGY MAGAZINE OF THE YEAR 2012 • DMA EDITOR OF THE YEAR 2012 • BSME EDITOR OF THE YEAR, SPECIAL INTEREST 2012 • D&AD AWARD: COVERS 2012 • DMA EDITOR OF THE YEAR 2011 • DMA MAGAZINE OF THE YEAR 2011 • DMA TECHNOLOGY MAGAZINE OF THE YEAR 2011 • BSME ART DIRECTOR OF THE YEAR, CONSUMER 2011 • D&AD AWARD: ENTIRE MAGAZINE 2011 • D&AD AWARD: COVERS 2010 • MAGGIES TECHNOLOGY COVER 2010 • PPA DESIGNER OF THE YEAR, CONSUMER 2010 • BSME LAUNCH OF THE YEAR 2009



David Rowan

David Rowan



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Qashqai Range: URBAN 37.2-67.3mpg (7.6-4.2L/100km), EXTRA URBAN 55.4-78.5mpg (5.1-3.6L/100km), COMBINED 47.1-74.3mpg (6.0-3.8L/100km) CO₂ emissions 138-99g/km.

MPG figures are obtained from laboratory testing, in accordance with 2004/3/EC and intended for comparisons between vehicles and may not reflect real driving results. Safety Shield Technologies standard on Tekna grade only. NissanConnect standard on Tekna and n-tec grades (requires compatible smartphone). Model shown is a Qashqai Tekna. Refer to dealer for exact specification. Models subject to availability. Nissan Motor (GB) Ltd. The Rivers Office Park, Denham Way, Rickmansworth, Hertfordshire WD3 9YS.

An aerial night view of a city with a glowing car silhouette in the foreground. Two award banners are positioned above the car, each with a beam of light pointing down at it. The background is a dense cityscape with many lit-up buildings.

WHATCAR?

**Car of the
Year 2015**

Best small SUV

WHATCAR?

**Car of the
Year 2014**

Best small SUV

**What makes the Nissan Qashqai the
'What Car? Best Small SUV' for the second year in a row?**

Could it be its unique design or innovative features like Safety Shield Technologies? Perhaps it's the way NissanConnect seamlessly syncs with your smartphone? Or maybe it's the Nissan chassis control which gives it that responsive driving experience? With so many innovative features it's probably best you test drive and decide for yourself.

The award winning Qashqai – made Great in Britain.





GREAT WALL OF CHINA (2)

There's a brand new man-made wonder in China - but this time it consists of trees. More than a hundred billion of them are due to be planted by 2050, across an area equal to 42 per cent of the country's land mass, as part of the Green Great Wall forestation programme. The aim: to fend off the encroaching sands of the Gobi Desert, which engulf 3,600km² of grassland every year and smother Beijing in dust storms. According to research by the Chinese Academy of Sciences, it's already working.

"Our results show that it greatly improved the vegetation index and effectively reduced dust storm intensity in northern China," wrote Minghong Tan, associate professor of geographical science at the academy in a December paper.

Since its inception in 1978 as the Three-North Shelterbelt Forest Programme, the project has met controversy over its potential long-term disruption to the ecosystem. But with ten million km² affected by desertification globally, and a similar project planned for the Sahara, we see a leafy trend rising. **Kathryn Nave**

Lapland has liftoff

It may be at least five years until the first commercial space planes are available outside the US, but Karin Nilsdotter, CEO of Lapland-based Spaceport Sweden, isn't waiting around. Her goal: to make Sweden Europe's tourist gateway to space. "We're developing the infrastructure now," she says, "so that Sweden will be first to mind when the time comes."

In the meantime, the company offers space tourism experiences based here on Earth, including centrifuge g-force training, astronaut-style team-building courses, and Zero G parabolic flights. Nilsdotter is also working with the Swedish government (and with private companies including Virgin Galactic and XCOR) to lay the legislative groundwork for manned space flight. "We also have EU funding for a space startups incubator and accelerator," she says.

But why Kiruna, a small mining town 145km north of the Arctic Circle? Well, the nearby Swedish Institute of Space Physics has a launch range for rockets and stratospheric balloons, and the local Luleå University of Technology, with its focus on space science education, will supply the skilled workforce the spaceport will need. According to Nilsdotter, the town's remoteness works in its favour – low flight-density to the local airport means it can easily be converted to service space planes. "The opening up of space will create opportunities in everything from medicine and materials to fashion and food," says Nilsdotter, who was previously chair of Swedish Lapland Tourism. "I can't wait to go into space, I am a future astronaut. But I'm truly passionate about all the opportunities it creates here on Earth." Kathryn Nave spaceportsweden.com

This is a *Black Arrow*, a British rocket used to put satellites in orbit

**I want the wind in my
hair and the warmth
on my bottom**



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APPS OF THE MONTH



JOVIE

A fun app to splice your own mobile-captured videos with clips from movies, TV shows and celebrity interviews. Shoot what you want and *Jovie* does the rest to help you and your spare time result in a viral-ready clip. *iOS*, free jovie.co



NINTYPE

Keyboard innovation continues to heat up in the *iOS* world and *Nintype* is gaining traction in the speed-typing region. With a bit of patience and practice, the app could help you type up to 100 words per minute on your phone. *iOS*, £3.20 jormy.com



WIRE

This conversation-focused app is one of the latest in a long line of messaging services hoping to beat *WhatsApp* and *Snapchat*, but it does so with an elegant design and focus on blending videos, sounds and drawings into the discussion. *Android*, *iOS*, free wire.com



CLUE

Clue takes the gold for being the most elegantly presented tracker of the menstrual cycle we've seen – and we've seen a few. It wraps an aesthetic layer around science, and, at zero cost, is worth a look. *Android*, *iOS*, free helloclue.com



GHOSTERY

After a long line of releases on PC and *iOS*, *Ghostery* finally comes to *Android*. This web privacy browser helps stop companies, search engines and social networks from covertly tracking your movements from website to website. *Android*, *iOS*, free ghostery.com



THE ELDER SCROLLS ONLINE

It's only our weird choice as we have been playing this game almost every day this year. It may be a desktop release, but the sheer addictiveness has ticked *WIRED*'s boxes for 12 months. *PC*, *Mac*, £49.99 elderscrollsonline.com
Nate Lanxon

Children of the (green) revolution

A Vietnamese kindergarten is ensuring the next generation doesn't forget its agricultural heritage



T

HIS IS THE "FARMING KINDERGARTEN", A SCHOOL BUILT BY

Vietnamese architecture firm Vo Trong Nghia to bring 500 children closer to nature. "In Vietnam, many people are now quitting farming and moving to an urban area," says Masaaki Iwamoto, principle architect on the project. "But we wanted children to have their own vegetable gardens." The garden on the roof of the school, in Dong Nai province, currently grows crops including spinach, mustard greens and sweet potatoes. A shoe factory next door conveniently provides waste water, which is recycled for the school's irrigation and sanitation needs, meaning it uses 40 per cent less water than the average kindergarten. Ventilation across the site is boosted by the school's design – with three grassy courtyards and narrow 10m-wide walls creating a three-

leaf-clover-shaped loop, thus cutting energy consumption. "We simulated the wind flow using computational algorithms," says Iwamoto. "Despite no air conditioning, the classrooms are very cool, even in the tropical weather."

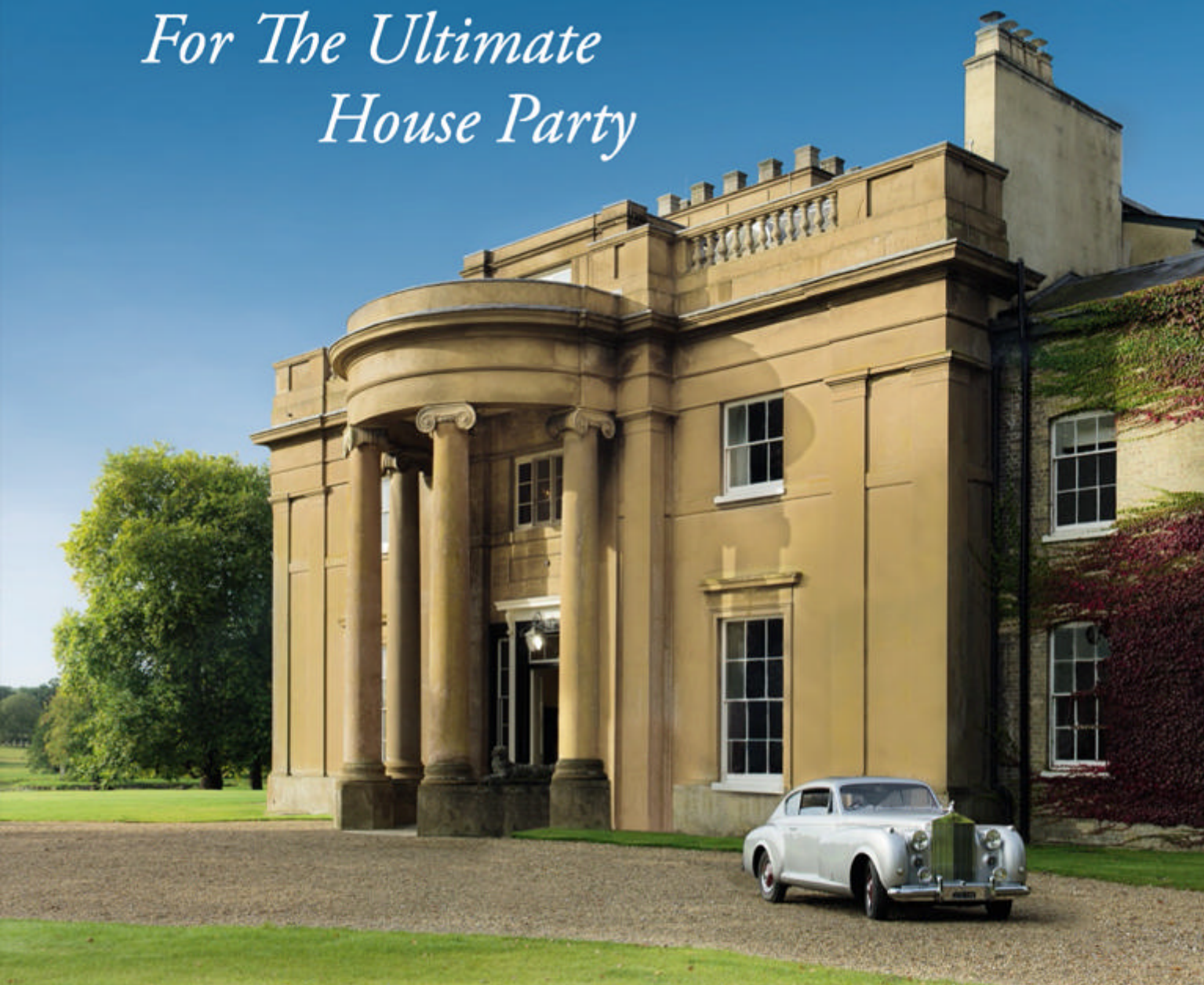
The kindergarten is primarily solar-powered – another lesson for the children, alongside the maintenance of the garden. "We intentionally designed many features in plain view," says Iwamoto. The green-minded architecture firm is expanding its reach to higher education buildings, and will finish its tree-covered FPT University building in Hanoi this year. Another building for the Ho Chi Minh campus is in the design stages, but will echo its garden rooftop approach. Green power to the children. **Sophia Epstein** votrongnghia.com

1 The garden is 150m², with plans to extend it to 3,400m² in order to feed all pupils.

2 Walls are shaded by concrete louvres; the green roof provides insulation.



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room with its Chinese wallpaper and to the bedrooms with their modern luxury and spectacular views. In the heart of rural Suffolk, Sibton Park can sleep 24 and the surrounding estate can accommodate an additional 50 guests. Facilities include a private cinema, games room, fitness room, tennis court and a stunning naturally-filtered pool with an integrated hot-tub.

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Uncorked potential

Heini Zachariassen's Vivino can sort the vintage from the vinegar

IF YOU LOVE WINE BUT ARE FAR FROM A CONNOISSEUR, Heini Zachariassen is here to help. His big idea: using data to help refine your taste. Zachariassen's app *Vivino* has more than 2.8 million monthly active users who discover and rate the five million vintages that the startup has catalogued. "I wanted to be able to walk into a supermarket, point at a bottle of wine and find out more about it," says the Vivino founder (*pictured*).

According to the Faro Island native, a total of 100 million scans have been made through the app. About 20 per cent of *Vivino*'s users also rate the wines they drink. "This is how we know

you like Pinots but not Zinfandels, and that mapping is very important in what we recommend to you," he says. "We find the users that have given the same wines a rating within 0.5 of your ratings, then *Vivino* recommends the other wines that this user likes."

By analysing wine reviews, Zachariassen has discovered some interesting taste patterns among drinkers. "For instance, if you're a white wine drinker looking to start a red wine, you should try a Beaujolais," he says. "We have found that people who love French whites such as a Burgundy also enjoy Beaujolais more than average, which can't be said for other red wines. Beaujolais reds are usually nice, light and easy wines, perfect for the transition from white to red."

In November 2014 the San Francisco-based startup launched a restaurant version of *Vivino*, whereby users can take a photo of a wine list to see which bottles have the best ratings. More than 100,000 lists were scanned in the first two weeks. Using the locations of each scan made through the app, *Vivino* hopes to build up an inventory of wines around the world by the end of 2015. Next up? "We want to let people buy wine through the app," says Zachariassen. "We can tell people what's available at which merchants, and let them order as much as they like." Better start cleansing that palate. **MV** vivino.com

SOME RECOMMENDATIONS FROM VIVINO

WINES TO BEAT THE WINTER BLUES

Melka C.J. Napa Valley Cabernet Sauvignon 2010 **[3.7]***

Larson Cabernet Sauvignon 2009 **[3.4]**

Hess Allomi Cabernet Sauvignon 2012 **[4.0]**

THE BEST OF ENGLISH FIZZ

Nyetimber Classic Cuvée **[3.9]**

Chapel Down Vintage Reserve Brut **[4.0]**

Ridgeview Wine Estate Bloomsbury Brut **[4.0]**



AI FROM RUSSIA WITH LOVE

Russian Siri-alternative IO doesn't just answer questions – it can hold a conversation. "We use AI algorithms to make sentences based on rules, rather than using set phrases or a script," says Moscow-native IO CEO Zhenya Kuyda, 28. "Unlike Siri it has a memory, so it can build up a contextual dialogue." Launching this month in New York, with plans for Moscow- and London-based versions, the service provides personalised recommendations via text message through machine learning and AI. It crunches data from sources including Yelp and *The New York Times*, as well as social media reviews and previous choices. WIRED asked for a cosy Italian place, and IO responded, "I'd recommend il Buci Alimentari e Vineria. A great little Italian place with friendly service," before asking what our favourite Italian places were. Ultimately, Kuyda wants IO to be a lifestyle concierge. "It can plan an evening in, and recommend takeaways and films on Netflix," she says. **MV** talkto.io



Where the drones roam

PETULANT MAN-BOY TYCOONS IN THE US WISHING TO COMMAND

armies of quadcopters are sulking because the Federal Aviation Administration has yet to finalise rules on how commercial drones ply the sky. Curses! Elsewhere, though, drone-enabled deliveries are starting to get off the ground. These pint-size copters can quickly ferry lifesaving supplies to remote places, deliver books on the double, and, yes, drop off pepperoni pizzas. **Lauren Smiley**



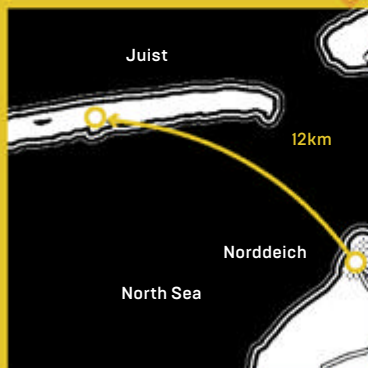
DHL PARCELCOPTER

Max payload
1.18kg
Max range
12km
Width
103cm



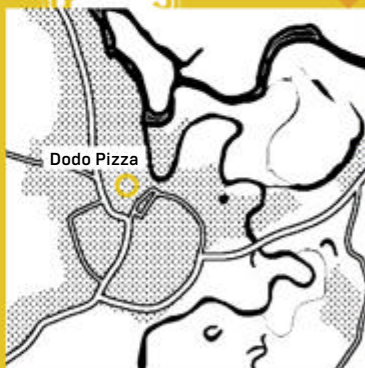
COPTER EXPRESS OCTOCOPTER

Max payload
3kg
Max range
2.7km
Width
76cm



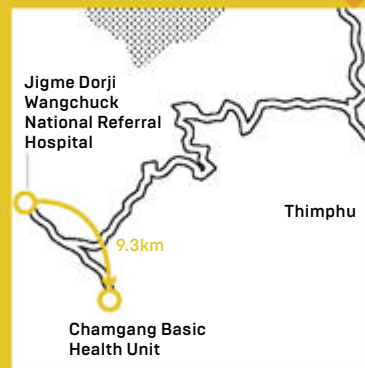
The North Sea

Payload Medicines including painkillers or anticoagulants.
Method Automated (but a pilot monitors the flight).
Status A local ferry service makes daily runs to the island of Juist, but the drone is for more urgent orders; the flight takes a mere 17 minutes.



Syktyvkar, Russia

Payload Pizza.
Method Preprogrammed via GPS and equipped with cameras monitored from the pizza restaurant; the food is dropped down to the customer on a cable.
Status If you're in Syktyvkar, just call Dodo Pizza and order Одну большую пиццу пожалуйста.

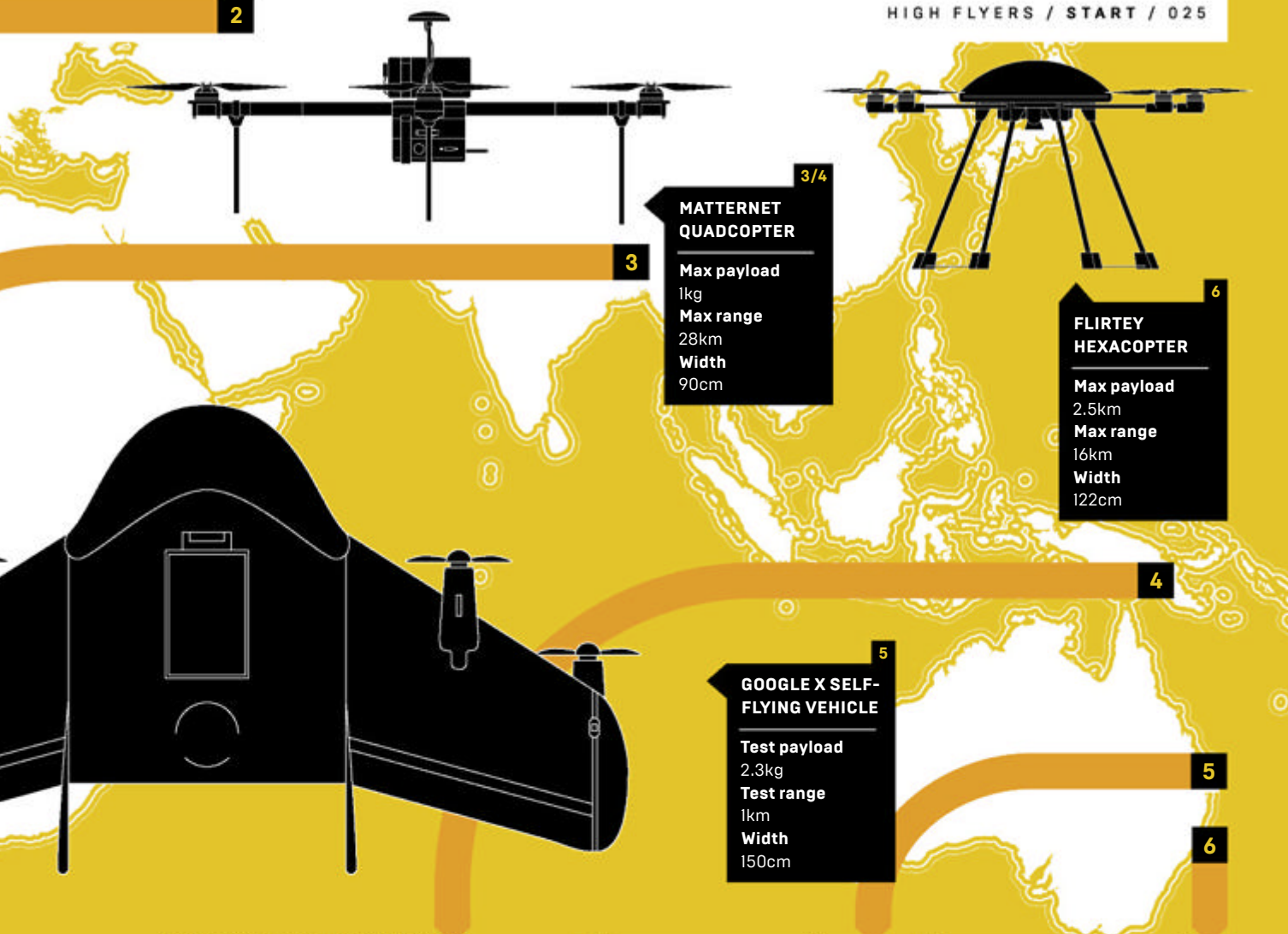


Bhutan

Payload Antibiotics from the hospital in the Himalayan capital of Thimphu, 2,350m above sea level, delivered to a remote mountain health clinic.
Method Automated (after operators program in the destination).
Status Tests ran in August 2014; a roll-out is planned for 2015.

Not all drone deliveries are part of a business model or humanitarian effort. Here are some of our other favourite delivery projects:

Sushi burgers (London); two large Domino's pepperoni pizzas (Redhill, Surrey); vegetarian burrito (Palo Alto, California); chicken wings (Milford, Connecticut); flower



MATTERNET QUADCOPTER

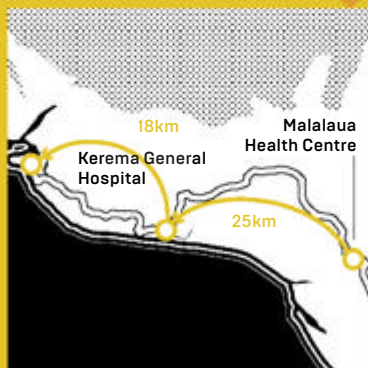
Max payload
1kg
Max range
28km
Width
90cm

FLIRTEY HEXACOPTER

Max payload
2.5km
Max range
16km
Width
122cm

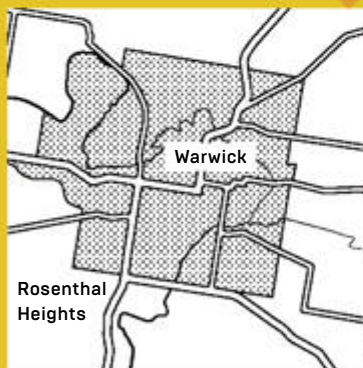
GOOGLE X SELF- FLYING VEHICLE

Test payload
2.3kg
Test range
1km
Width
150cm



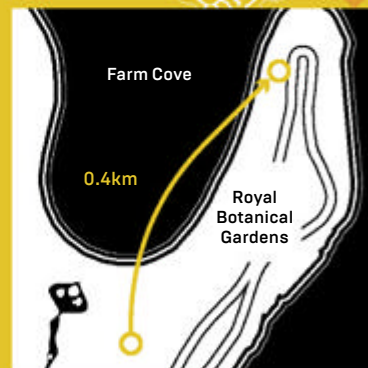
Papua New Guinea

Payload Saliva samples for tuberculosis testing, from Malalaua Health Centre to Kerema General Hospital; the drone shortens what can be a days-long overland trip to one hour.
Method Automated.
Status Tests ran in September 2014 in anticipation of a 2015 roll-out.



Queensland, Australia

Payload Dog treats, cattle vaccines and a first aid kit for farmers.
Method Will be preprogrammed; once in position, it lowers the package on a line and a bundle of sensors detect when the package has hit the ground.
Status It's still in the early-stage research process.



Sydney

Payload Physics and law textbooks to students at the University of Sydney (who support Flirtey, the delivery startup), reducing delivery time from two to three days to a few minutes.
Method Automated.
Status More testing is ongoing at the University of Nevada, Reno.

Scaling Dublin's Summit

Paddy Cosgrave has grown his Irish tech event from just 150 people to more than 22,000 – using data as his guide.
By João Medeiros



PADDY COSGRAVE ORGANISED HIS FIRST CONFERENCE, Founders, in October 2009 in Dublin: 150 people turned up. In November 2010, he ran a combination of two events, Founders (not to be confused with Founders Forum) and the first Dublin Web Summit, which attracted around 400 people – including Jack Dorsey and Chad Hurley, cofounders of Twitter and YouTube. In November 2014, according to Cosgrave, more than 22,000 people attended Dublin's Web Summit, and sister events ran in New York, Hong Kong and Las Vegas.

Cosgrave, 31, studied economics and politics at Trinity College, Dublin, but “was always building things online with friends, from invites for parties to a really bad social network that nobody used,” he says. Now his technology events host speakers from Peter Thiel to Eva Longoria, and employ over 100 people. Cosgrave spoke to WIRED about how he grew his event into one of Europe's biggest tech conferences. websummit.net

Paddy Cosgrave in the Long Room of Trinity College Library, Dublin. The first Web Summit was held at Trinity



What inspired you to create the first Web Summit?

I organised a conference when I left college [Trinity College, Dublin] and found out very quickly that the conference industry, although amazing in bringing inspiring entrepreneurs together, was very unscientific and un-technological. I think you can make conferences better by using statistics and a little bit of code. The first conference was in October 2009 in a small hotel in Dublin. It wasn't properly organised and about 150 people turned up. I thought nothing of it; I had no interest in conferences whatsoever. But I thought it was good for Ireland – you have all these great tech people who would fly to London or Paris or Berlin and I was like, “Why the hell does nobody come to Ireland?” So I just invited some people. It wasn't until October 2010 that we turned it into something more meaningful. Four hundred people showed up. We had Jack Dorsey, Niklas Zennström and Chad Hurley.

What do you think attracted people to what was then an unknown event?

I just said, “Come and speak and also spend some time with each other.” Most of them had never been on a pub-crawl before. In 2011, Bono agreed that he would host one of the pub crawls, and that became an attraction in its own right. Every year he takes 15 other founders, from Elon Musk to Drew Houston to Reed Hastings, on a magical pub crawl of Dublin. Oddly, people in Silicon Valley who make the software that connects the world don't get a lot of time to meet each other. In Dublin there are no distractions so you can hang out for two-and-a-half days.

What role does technology play in how you organise your events?

Our growth has been largely propelled by network science. All we've done over time is to expand on that approach of engineering serendipity at the scale of 20,000 attendees. There's a huge amount of randomness at events so we try to take control of some of that using algorithms for optimal outcomes. In 2010, I was putting together the table plans for the first event. It was three days, with dinners, lunches, breakfasts and pub-crawls, with about 200 people each. I asked event organisers how to draw up a table plan. They said it's really hard, you have to be so careful and focus on the top table to begin with. I didn't want a top table; I wanted to evenly distribute everybody across these 20 tables of ten. I sat down with a friend who is an applied statistician [Kevin Cunningham, now campaigns targeting and analysis manager for Labour] and we just created a pretty basic brute-force algorithm that just created the seating plans based on a number of constraints.

FAMOUS FACES

Web Summits are a tech who's-who. Here are just three.



Elon Musk
CEO,
Tesla



Danae Ringelmann
Founder,
Indiegogo



Peter Thiel
Founder,
Founders Fund

How do you develop the data science behind the event?

We hire applied statisticians, engineers and physicists with a background in complex systems and network analysis. With the social web, you can increasingly see the connections people have to other people, so we apply that insight to something as simple as our chat app and a networking app at the Web Summit. If you're a developer, we see the types of people that you want to connect with, so we have a recommendation system based on what we know about you and the rest of the delegates. It turns out, for example, that we hadn't realised that many of the startups that attended weren't looking for investors, but for talent – specifically, they were looking for developers. We had never got to see that at scale, because we were never able to see in real time who was actually connecting with whom. So that allows you to think about how you improve and build the system the next year.

Does data contribute to your speaker selection?

We use software called NetworkX to look at networks. So, for instance, if you want to figure out who is the single most important speaker for a given community, the algorithm helps us discover who people look to the most. It turns out that Gavin Andresen, the chief scientist of the Bitcoin Foundation, is, among the hardcore bitcoin community, the person that people look to most. We use that approach to help us figure out who should come and speak on certain topics on certain stages.

Regarding how delegates interact during a conference, was there any insight from the data that surprised you?

Conferences don't end at 5pm, according to our [networking] data. In terms of people communicating with each other through the app, we found that there's a flurry in the morning, probably related to planning meetings, and then from 7pm to 10pm there's a flurry of activity again. So that's when we put on lots of small events to cater for different communities. It could be as granular as a Python meetup, so if you want to recruit a Python developer, you can go crash that party.

What else have you learned?

I see a lot of mistakes at our conference. For instance, we looked at queuing. It turns out Disney has done lots of pretty compelling research on queuing and how to improve the queuing experience. One of our

scientists has a background in machine vision so we have GoPros all over the venue and, just like Walmart tries to improve the flow of people through their stores, we use the footage to try to improve the flow of people through an exhibition area.

You are expanding to other global cities, with new conferences such as Collision, held in downtown Las Vegas last May. What is your strategy for expanding into unfamiliar territories?

Collision is growing at a faster rate than Web Summit ever grew. It'll probably go from 1,500 to 10,000 attendees in basically a single cycle, which is reasonably substantial growth. We're also expanding to Hong Kong and into verticals. We're going to do an event in the payment space and we're going to do one in the currency space and one in the enterprise space. So many of our hires out of the last six months have come from SF, London, Berlin, Milan, Moscow, Australia, Madrid, just other places around the world. I think maybe another 100 people will join the company over the next 12 months and many of those will come from abroad. ■

‘Bono agreed that he would host a pub crawl. Every year, he takes 15 founders on a magical pub crawl of Dublin’



Dealmakers *in* Technology

35 successful transactions completed in 2014



POZITRON
sold to
MONITISE



13TH LAB
sold to
FACEBOOK



PINGDOM
sold to
SOLARWINDS



FETCH
sold to
DENTSU AEGIS



LIBRATONE
sold to
CHINESE INVESTORS



PAYONE
sold to
DEUTSCHER SPARKASSENVERLAG



CAMBRIDGE TECHNOLOGY PARTNERS
sold to
ATOS



TEXTLOCAL
sold to
IMIMOBILE



KLARNA
Sale of Öresund's and Creades' equity stakes



DELIVERY HERO
Series F funding round
US HEDGE FUND



MYOPTIQUE
Private placement
BERINGEA KORYS



CAR LOAN 4U
Private placement
SCOTTISH EQUITY PARTNERS

GP.Bullhound

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tel. +49 30 410 80 600
Oberwalstrasse 20
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Germany

MANCHESTER

tel. +44 161 667 2290
1 New York Street
Manchester, M1 4HD
United Kingdom



T

HIS IS THE WORLD'S only museum devoted to the misunderstood microbe – the tiny, invisible creatures that make up two-thirds of all life on Earth. “It took

us ten years to develop this because it’s never been done before,” says Eveline Hensel, the 33-year-old director of Micropia, the Amsterdam-based oddity which opened in October last year. “But now we’re open, it’s hard to accept we are the only one in the world, because microbes are such a large part of our lives.”

Each human has more than 100,000 billion microbes living in and on them – about 1.5kg of our total weight – and Micropia’s interactive body scan exhibition allows visitors to see which ones make up their own personal “ecosystem”. They play a role in conditions including obesity, allergies and even our mental health. Meanwhile, the Kiss-o-Meter analyses which microbes are exchanged when you pucker up.

On-site scientists grow and look after 250 types of microbe for visitors to observe. “There’s an organism called the water bear: he lays eggs in his own skin,” says Hensel. “At Micropia you can see the water bears hunting, eating, moving and mating, and also their eggs hatching.” 3D microscopes were designed and built especially for the museum, and each one has a connected screen so even if you’re not looking through the lens you can watch the micro-activity. “We want to make people enthusiastic about the life they’re surrounded by, which we often don’t see, and to inspire young people to study microbiology,” says Hensel. “We decided if we really wanted to make that happen, we would have to make the invisible visible. Because seeing is believing.” Zoos: you’ve been disrupted. **SE micropia.nl**

INSIDE THE LIVES OF MICROBES

Roll up, roll up! See some of the world’s smallest creatures up close and personal at an Amsterdam museum

Above: Micropia links microbes to the museum visitors themselves

Right: a water bear is magnified 700 times to be visible to the human eye

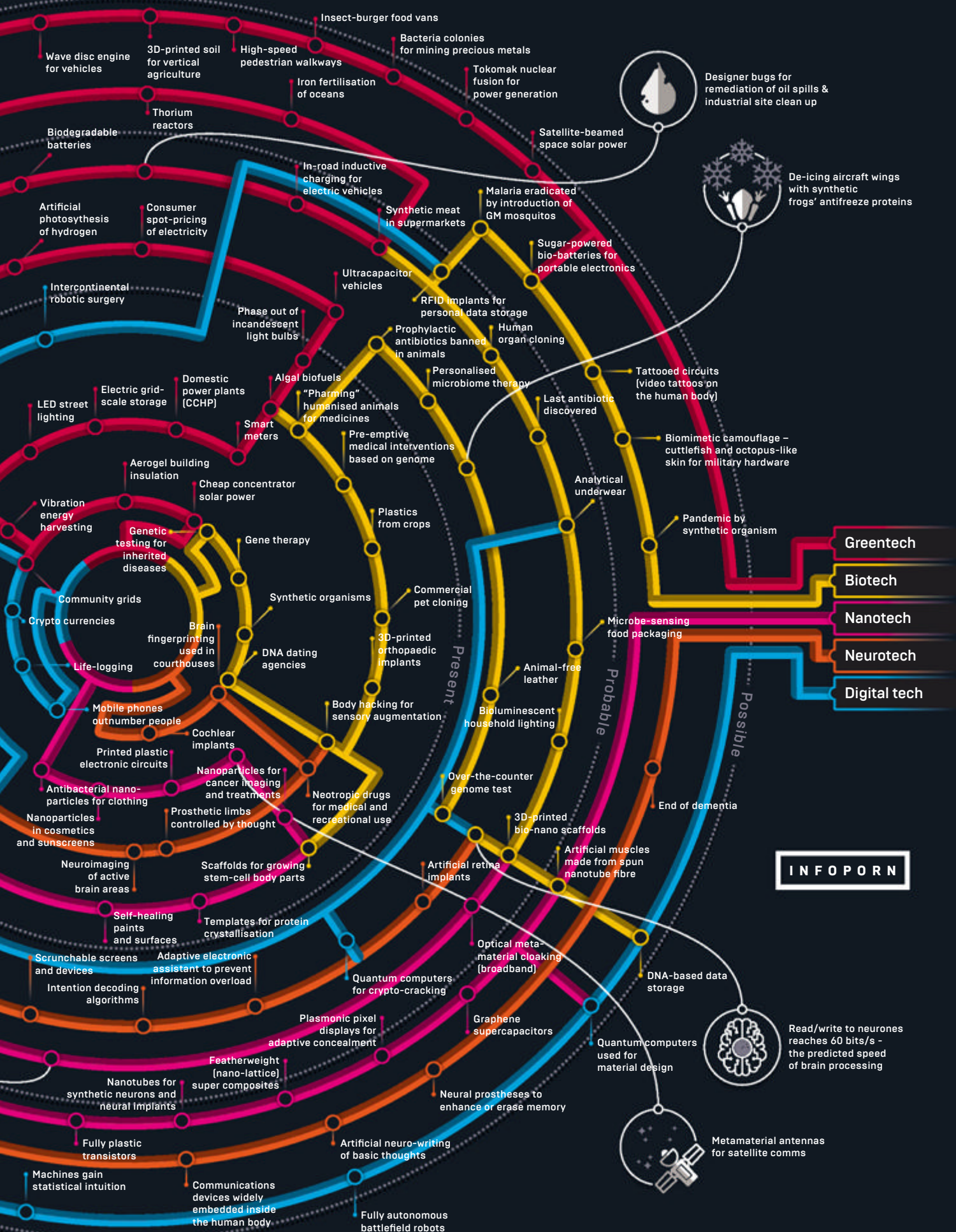


This is a snapshot of this magazine's potential stories, for the next 50 years: 148 life-changing technologies, trends and big ideas that you need to know about right now. "Nothing on the map is something a scientist today isn't working on," says Alex Ayad, who runs Imperial College London's Tech Foresight Practice, which makes data-driven predictions about science and technology. The concentric timeline, created by Ayad and British futurist and writer Richard Watson, divides these emerging ideas into five categories – nanotech, neurotech, greentech, digital tech and biotech – and separates them into three time zones: Present, at the graph's core; the Probable (from 2015 to 2030), which is further outwards; and the Possible (beyond 2030), at the graph's outside edge. The data was sourced with the help of Imperial's Smarties, a community of 900 graduates who pool their knowledge to solve unique problems. For an idea to qualify in the Present timezone, such as prosthetic limbs controlled by thought, or DNA dating agencies, there had to be at least 1,000 known instances of its use. The most surprising insight was the interconnectedness of the five categories. "The further along in time we moved towards the Possible category, the more we found the various trends become interdependent, and began to merge with one another," Watson says. **MV toptrends. nowandnext.com imperialtech foresight.com**

INFOGRAPHIC: STUDIO DOT INFO

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[illegible]



What will advertising look like a decade from now?

THE BIG QUESTION



SUE ANDERSON

EXECUTIVE CREATIVE DIRECTOR, CRISPIN PORTER + BOGUSKY

"As opportunities to talk to people are squeezed out of TV and printed media – and ultimately out of desktops – and into mobile, we will have to ensure brands have a strong voice and a point of view. We will have to give consumers information and inspiration that is genuinely useful. Soulless one-liner ads with end gags will hopefully die. People will become loyal to the brands that they feel understand their values, and this will make them seek those brands out, without brands having to yell to seek people out." Kathryn Nave



NAVEEN TEWARI

FOUNDER AND CEO,
MOBILE ADVERTISING NETWORK INMOBI

"The future of advertising will be about anticipating what a user is going to do in the next minute, hour or day – and using this to aid visual discovery of products and services. This will require a convergence of big data, creative ad formats and cognitive sciences, made possible because of the mobile platform's capabilities. Companies that are able to deliver on this will thrive."



MEREDITH LEVIEN

EXECUTIVE VICE PRESIDENT OF
ADVERTISING, THE NEW YORK TIMES

"Brands will continue on their march to being creators and distributors of valuable programming worthy of competing for our attention. Likewise, advertising will become one of the higher-IQ enterprises of our society, requiring the cleverness and creativity of journalism and entertainment, and the technological prowess to solve every imaginable consumer problem."



JOHN HEGARTY

COFOUNDER, BARTLE, BOGLE,
HEGARTY; THE GARAGE

"Media fragmentation, increased competition for an audience's attention, growing scepticism with marketing and corporate disillusionment: advertising's usual answer to this is to devise more devious ways to dupe the public into getting their messages. Seeing is not believing. In a fragmenting world, a brand needs a big unifying idea that is daring, inspiring and shareable."



NICOLE YERSHON

DIRECTOR, INNOVATIVE SOLUTIONS,
OGILVY GROUP ADVERTISING

"The next evolution of advertising is far beyond linear channels of communication. Brands and agencies need to collaborate with technology companies, startups, media owners, designers, academics and more, in order to tell an engaging story to relevant, niche audiences. Brands are there to facilitate conversations, not dictate them."



HENRY STUART

COFOUNDER, VIRTUAL-REALITY
AD STARTUP VISUALISE

"Virtual reality brings huge potential for advertising – you could not have a more captive audience than someone with a headset, immersed in your content. Creating advertising material in VR means curating a whole environment that the user will associate with the brand. Facebook's involvement is going to push VR towards these populated virtual spaces."

MIGHTIER. COOLER. AND SUPER-ER THAN EVER.

It's a good time to be a fan of the big screen. In April, Marvel's eagerly awaited film, *Avengers: Age of Ultron*, finally explodes into cinemas around the world. But right here and now, Samsung is blowing minds with the latest generation of its original phablet, the awesome GALAXY Note 4. And just as the Avengers are brilliantly equipped to fight off even the mightiest villain, the GALAXY Note 4 has super powers of its own to help you in pretty much every situation.



Samsung
GALAXY Note 4 ×

MARVEL
AVENGERS
AGE OF ULTRON

IN THEATRES 24.04.2015

THE SUPER SIX

The original *Marvel's Avengers: Assemble* movie was a game changer of epic proportions. It made us realise we didn't have to settle for just one costume-clad world-saving Super Hero. We could have six.

Similarly, the game-changing GALAXY Note 4 is far from being a one-dimensional Super Hero. So we decided to see how the powers of the mighty Avengers and those of the GALAXY Note 4 compare. What did we find? Well, let's just say you don't have to be Tony Stark to get your hands on the best technology around...

Samsung
GALAXY Note 4



AVENGERS
AGE OF ULTRON

IN THEATRES 24.04.2015

Ready, Set, **STRATEGISE.**

Strategise like Captain America. Use S Pen to collect, combine and share all the stuff you want to.



Ready, Set, **CAPTURE.**

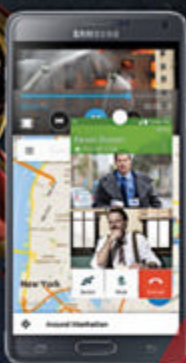
A camera that shows the whole picture is perfect for Hulk. No matter how massive the moment, capture it every time.





Ready, Set, **FUSE**.

Get things done faster by fusing multiple screens into a single view. Command your vision like Iron Man.



MULTI WINDOW



Ready, Set, **SHARPEN**.

The 5.7" Quad HD Super AMOLED display adapts to all conditions. Enjoy a viewing experience sharper than Hawkeye's arrows.



ADVANCED DISPLAY



Ready, Set, **ORGANISE**.

With cunning worthy of Black Widow, stay organised by turning images into digital notes you can edit.



PHOTO NOTE



Ready, Set, **POWER**.

Supercharge your battery with the same power as Thor. Hit 50% in about half an hour and keep going for longer.



FAST CHARGE

READY, SET, GO.

The GALAXY Note 4 takes the concept of the phablet and turns it into something truly mighty. In fact, it's set to become a modern-day hero of the masses. And to show we're not just all talk, visit www.samsung.com/galaxynote4 where you can find out more about these amazing features:

SMART SELECT

Use S Pen to easily choose the contents you want from any text, screen or app. Put together what you select, then share and save at once.

MULTI WINDOW

Gain flexibility by managing multiple applications at the same time on a single screen. The feature is highly intuitive and a great time saver.

ADVANCED DISPLAY

The high contrast of the 5.7" Quad HD Super AMOLED display will drive you to feel the rich color as if you are looking with the naked eye. And it comes optimised for web browsing.

ADVANCED CAMERA

A 3.7 MP front-facing F1.9 lens camera, and a 16 MP Smart OIS rear camera provide you with the best results for every moment of your life, even in dark surroundings.

PHOTO NOTE

A fantastic new way to take notes. Turn your images and text into digital notes, then edit and colour them with S Pen.

FAST CHARGE

Thanks to charging speed improvement, you can now take your Samsung GALAXY Note 4 battery to 50% in around 30 minutes.



5.7" Quad HD Super AMOLED



Fast Charging



Bright & Stable Camera



Seamless Multi-tasking



Smart Select

Frost White



Charcoal Black



Samsung
GALAXY Note 4

MAGAZINE

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WIRED'S ANNUAL REPORT IS YOUR GUIDE TO THE MUST-KNOW TRENDS OF THE YEAR AHEAD, AVAILABLE IN PRINT AND DIGITAL

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FOLLOW US ON TWITTER, FACEBOOK, TUMBLR, INSTAGRAM AND GOOGLE+ TO JOIN THE DEBATE AS IT HAPPENS

The

WEARABLES AS HEARABLES

Bragi's earbuds play tunes – and track health

The tiny device

nestled in Bragi CEO Nikolaj Hviid's ear is The Dash, a new wearable device from the Munich-based startup. Like regular headphones, they play music via a Bluetooth connection and can hold up to 1,000 songs in their 4GB flash memory. But they are also health monitors that track heart rate, blood oxygen saturation, calories burnt and exercise metrics. The Dash can even select music on the fly, based on your personal biometrics.

The sensor-packed earphones – which won the CES Best of Innovation Award in November 2014 – raised more than \$3.3 million (£2.2m) on Kickstarter – ten times its target. After spending

six months on the design, the Dash team has working prototypes and says it will ship the device this spring for \$299 (£198).

The Dash's two earbuds connect wirelessly with each other, and nine sensors track movement and body vitals. A jawbone microphone, meanwhile, picks up voice while limiting background noise (a "transparent audio" feature can

mix background sound in or out with a slide of the touch controls). The Dash can also combine different data sources to guide you while exercising.

"What we're doing is on the edge of impossible," says Hviid, 40. The Danish founder certainly has form: he was previously the head of design at audio firm Harman (which operates brands including AKG

and JBL), and his 30-strong team boasts expertise from AKG to Apple, with ten science postgraduates.

Hviid says The Dash could be developed to read head gestures to steer a wheelchair, or be used as a real-time language translation device between users. WIRED is just happy that the days of tangled headphone leads could be numbered. **Jeremy Kingsley** *bragi.com*



Your ears are a different shape to Nikolaj Hviid's? Don't worry: The Dash comes in three sizes



I ♥
MY CEO

Have issues with your boss? Job site Glassdoor has built a database of employee reviews. Meet the bosses workers rate – or slate (total reviews in brackets). SE

100% (4)
Susan Wojcicki
YouTube

93% (2,312)
Tim Cook
Apple

96% (1,576)
Larry Page
Google

91% (148)
Elon Musk
Tesla

82% (1,383)
Satya Nadella
Microsoft

81% (154)
Jeremy Darroch
Sky

80% (580)
Marissa Mayer
Yahoo!

72% (295)
Travis Kalanick
Uber

60% (15)
Gavin Patterson
BT

49% (21)
Tony Fadell
Nest



UPERMASSIVE STARS

with a mass between 55,000 and 56,000 times larger than our Sun, don't behave like normal stars. In this simulation of one exploding, physicists have discovered that when they die they don't form a black hole, as dying stars usually do. Instead they explode as a supernova – a stellar eruption that briefly outshines the entire galaxy. The idea: this could have led to life on Earth.

"These explosions would have had a dramatic impact on the early Universe," says Ken Chen, post-doctoral researcher at the University of California at Santa Cruz and lead author of the study in *The Astrophysical Journal*. "The elements made inside the star would have been ejected in a supernova explosion." And a super-massive star would have produced large quantities of oxygen, carbon and metals.

"These metals are important, as they form the building blocks for Earth," says Chen. "Even if a tiny amount didn't exist then everything would have been different." He is now working out what kind of metals and isotopes would have been formed – thus explaining their role in the evolution of life. "Ultimately, this could improve our understanding of the Universe," he says. SE

Explosive results from the lab

This simulation could unlock the Universe's secrets



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OWNERSHIP? SO LAST SEASON...

From ready-to-wear to couture, hiring posh togs for a fraction of the garment price is currently *en vogue*. "It's access without the overheads of ownership," says Girl Meets Dress cofounder Anna Bance. Here are five styles. **SE**

1 GWYNNIE BEE closet.gwynniebee.com

A monthly subscription service, Ohio-based Gwynnie Bee occupies a 100,000m² warehouse. Founded by Christina Hunsicker, it claims over 1,500 plus-size styles for US sizes 10-32 (UK 14-34).

2 MY CELEBRITY DRESS mycelebritydress.com

Putting a red-carpet spin on rental, My Celebrity Dress lets you choose garments based on which celebrities have worn them: fancy a go in that dress worn by Cheryl Cole on *The X Factor*? It's £65.

3 THE MR COLLECTION themrcollection.com

Companion to The Ms Collection, this California-based monthly rental subscription service for men includes clothing and accessories. Stylists customise three to five items in each delivery.

4 CINDERELLA ME cinderella-me.co.uk

Yep, there are footwear rentals too. If you don't mind walking in others' shoes, try Alexandra Hones's Cinderella Me. Members pay per hire: it's £50 a week for a pair of £500 Jimmy Choo stilettos.

5 GIRL MEETS DRESS girlmeetsdress.com

London-based Girl Meets Dress launched in 2009. Cofounders Xavier de Lenclos-Aguise and Anna Bance have expanded into Europe and stock 4,000 frocks from more than 150 designers.

ILLUSTRATION: DANIEL CLARKE



G is for green

Plant power is cleaning up Amsterdam's air

AMSTERDAM IS ABOUT TO BE ENCIRCLED BY A GIANT letter G – a park planted with specially modified honeysuckle that has been designed to capture air pollution.

Engineer Ton van Oostwaard, 58, started the seven-year project in January and plans to build a 25,000-hectare G-shaped park in 36 stages. He's starting in the cemetery near the Amstel River where Dutch astronaut and climate change activist Wubbo Ockels was buried last year. Van Oostwaard expects his urban design concept to

grow beyond Amsterdam. "We've been in contact with developers in Shanghai and Korea," he says. "So it might be possible to take the concept into other cities."

So, why honeysuckle? It seems the hair on its leaves, stem and flowers have useful anti-pollution qualities. "We irrigate the plants with liquid aminos after they have spent ten to 18 months in the greenhouse," says van Oostwaard. "That increases the strength of the hairs, so each plant gathers more pollution." He estimates that the modified honeysuckle will also produce 640,000 tonnes of biomass over a five-year period, which can then be converted into enough biofuel to heat every home in Amsterdam for a year. "It turns pollution into a resource," he says. This fuel will then be used to heat Schiphol airport, and the 40m-plus people travelling through it each year.

The honeysuckle has also been bred to withstand rising temperatures. "We're future-proofing the plants," Van Oostwaard says. "We planted them in locations that are 5°C above Dutch temperature to take into account climate change." The land being used for the concept was once Amsterdam's "defence line", which safeguarded citizens from floods between 1874-1914, but now it will provide the city with a new type of protection. The city could soon be known for a different kind of bud. **Sophia Epstein** *ecorridors.nl*

Geologycraft

The best way to give kids access to geographic data?
Simple: recreate entire countries in Minecraft



East London
rebuilt in *Minecraft*
by the BGS. The
entire UK version
will contain
trillions of blocks

MINECRAFT HAS BEEN USED TO BUILD replicas of fantasy worlds including Hogwarts and Westeros. Now, the British and Danish governments want to play – but they are charting the geology of real countries. “*Minecraft* is an accessible tool for navigating and manipulating a digital landscape,” says Suzanne Dael of the Danish Geodata Agency, a branch of the country’s Ministry of the Environment. “It’s a way to make our national geodata more accessible to new users – in this case, children.”

Dael’s team was the first to show an elevation model of Denmark in 3D inside *Minecraft*, rather than in two-dimensional topography. Geospatial algorithms translated latitude co-ordinates captured from airborne laser scans into *Minecraft* blocks. The conversion took around 80 hours and contains 3.6 million buildings. Released in April 2014, the model has been downloaded more than 300,000 times.

The British Geological Survey (BGS) has also begun work on its version of a *Minecraft* UK, with co-operation from the Ordnance Survey. It will even go below ground to show the layers of soil beneath our feet as they change all the way down to the Earth’s core. When BGS showed its model in schools, it was surprised to discover that students who knew little about geology understood certain *Minecraft*-related geological words, such as obsidian, a term for a glass-like volcanic rock used in the game. Lesson to parents: less homework, more video games. **Chris Stokel-Walker**

EARLY ADOPTERS



WHAT’S EXCITING...

IAIN SIMONS

Director,
GameCity

“Fragments of information fall away from me like digital dandruff; note-taking app *nvALT* proposes an intuitive, free and fast solution. A text field is both your omni-search bar or declares a title. You create and search plain text documents. It never crashes. Dandruff clears.”



WHAT’S EXCITING...

FIONA DISEGNI

Founder and CEO,
Rentez-Vous

“*rendeevoo* is a new mobile app for flirting. Its motto: ‘Flirt responsibly’. You get notifications of people around you interested in offering you drinks – or you can choose to pay for them yourself. You can maybe find the person you are waiting for – or use it as a new way to try new cocktails...”



WHAT’S EXCITING...

LES COCHRANE

Cofounder,
BorrowMyDoggy

“Turning location-based data into visualisations was difficult and time-consuming until I recently discovered *CartoDB*. It’s fast, easy to use and can handle a range of data sources. The visualisations you can create make an instant impact and help make sense of your data.”

B

etween muddy trails and shorter seasons, global warming puts a bitter chill on the world's ski resorts. Typically, the solution is one beloved by cold-themed supervillains everywhere: snow guns! Such blowers used to be expensive to run, but new versions, such as Snow Logic's DV4, expectorate winter

wonderlands more efficiently. The upshot for one Vermont resort this season: \$235,000 (£155,000) in projected savings, a 1.17-million-kg reduction in carbon emissions, and slopes full of happy, mogul-carving skiers. **Danielle Venton**

POWDER PUFFER

How low-emission snow guns are saving ski resorts from dry seasons

1. WATER NOZZLE

Water blasts out through a cruciform nozzle; the perpendicular planes disrupt each other, breaking the

stream into lots of tiny droplets. That increases the liquid surface area exposed to the air and speeds up freezing.



2

4

2. NUCLEATOR

Snowflakes can form at higher temperatures if they grow from a seed – a piece of dust, a grain of silver iodide, or in this case, an ice crystal. Compressed air shoots ice particles from the nucleator into the water spray, where the H₂O molecules freeze around them.

3. COMPRESSION

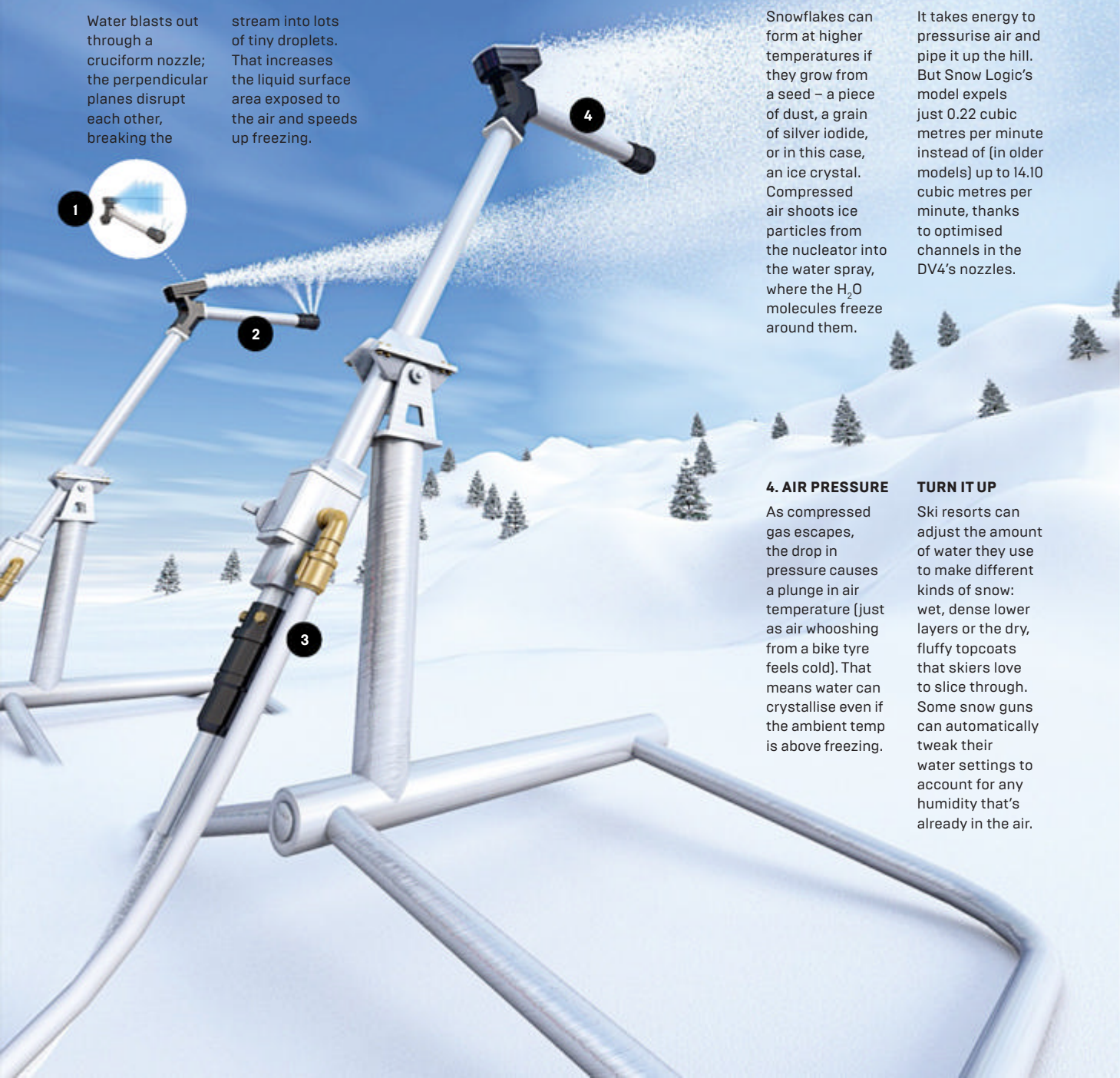
It takes energy to pressurise air and pipe it up the hill. But Snow Logic's model expels just 0.22 cubic metres per minute instead of (in older models) up to 14.10 cubic metres per minute, thanks to optimised channels in the DV4's nozzles.

4. AIR PRESSURE

As compressed gas escapes, the drop in pressure causes a plunge in air temperature (just as air whooshing from a bike tyre feels cold). That means water can crystallise even if the ambient temp is above freezing.

TURN IT UP

Ski resorts can adjust the amount of water they use to make different kinds of snow: wet, dense lower layers or the dry, fluffy topcoats that skiers love to slice through. Some snow guns can automatically tweak their water settings to account for any humidity that's already in the air.





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WIRED's one-day event exploring how new ideas, technology and innovation are disrupting the health sector returns for its second year

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S

ANGEETA BHATIA HAS BUILT AN ARTIFICIAL liver using computing tools. “The premise is to borrow technologies invented in other areas, such as microprocessor manufacturing, and apply them to human health,” says the biomedical engineer and director of the Laboratory for Multiscale Regenerative Technologies at the Massachusetts Institute of Technology (MIT). To arrange cells in the complex configuration needed to build a human organ, Bhatia turned to photolithography – a method used to etch circuits on silicon microchips. The result is a pinhead-sized micro-liver (*pictured right with Bhatia*) that can be used to model hepatitis and other infections, as well as to test drugs. Bhatia has spun out a company called Hepregen to commercialise the invention. “We want to make implantable livers that would replace the need for transplants,” says the 46-year-old. “It is one of the only human tissues that can regenerate large portions of itself.”

Her team also invented a urine-based paper test for cancers. The patient is first injected with synthetic nanoparticles that interact with tumour proteins. “Those proteins cut off a fragment of the nanoparticle, which comes out in the urine,” says Bhatia. It has accurately identified colon tumours in mice, and Bhatia is forming another company – her third – to develop the invention for human use.

“I want to turn our potent ideas into products or companies or licences,” she says. “I want to shepherd our best inventions out into the world.”
Dan Cossins *lmrt.mit.edu*



Bhatia's lab has already grown small human livers in mice

Microprocessing the human liver

Sangeeta Bhatia is rethinking drug and cancer tests

PHOTOGRAPHY: SCOTT GOODWIN

WIRED	TIRED	EXPIRED
Progress	Innovation	Disruption
Regin-era cyberwar	Reagan-era Star Wars	Second Lucas-era <i>Star Wars</i>
E-cig malware	Car park USB vector	Floppy-disk trojans
<i>StarCraft</i> AI championships	Turing test	Computer chess



Main: Eddie Redmayne describes playing Stephen Hawking in *The Theory of Everything*
Top: David Rowan, Eddie Redmayne and Stephen Hawking at the screening
Middle: Redmayne and Hawking
Bottom: WIRED competition winner Maria Suarez, seven, with her grandmother



A WIRED evening with Hawking and Redmayne

Wired.co.uk competition winners enjoyed a private screening of *The Theory of Everything*

Stephen Hawking was surprised he was the subject of a major film, he told the 160-person audience at a WIRED screening of Universal Pictures' biopic *The Theory of Everything* in December. "At first, I was worried because it was based on a book by my ex-wife, Jane," he joked. "But I was reassured when I read the script, and even more when I saw a first cut of the film. It was surprisingly honest about our marriage, and my fight with ALS, or motor neurone disease."

WIRED editor David Rowan introduced the screening by interviewing Hawking and actor Eddie Redmayne, and putting questions posed by WIRED readers and BAFTA members. Asked what the most important cosmological observation after the Higgs boson would be, Hawking said, "It

would be detecting primordial gravitational waves. These would have propagated to us direct from the earliest stages of the universe, unlike light, which is scattered many times before it gets to us. [They] would tell us how the universe began."

Hawking also told seven-year-old Maria Suarez, who had flown in from Texas with her grandmother to attend, that his daughter Lucy and he are working with TV animation studio Nerd Corps to make a television series out of their children's science adventure books, the *George Greenby* series. When asked about his thoughts on Redmayne's performance, he said, "I thought Eddie Redmayne portrayed me very well. He spent time with ALS sufferers so he could be authentic. At times, I thought he was me."

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WHAT HI FI?
SOUND AND VISUAL

The **INDEPENDENT**

**HOW IT
WORKS**



FETISH

Its affiliated music download service, Technics Tracks, provides a large selection of 24-bit FLAC audio files



DIFFERENT CLASS

TECHNICS REFERENCE CLASS R1 SERIES

This flagship system from the newly resurrected Technics label comprises three elements: a stereo power amp, network player and floor-standing speakers. The latter utilise entasis-form, 1,260mm cabinets to get rid of unwanted resonance and diffraction reflection across their matching six-driver configurations. The hefty amp's Jitter Elimination and Noise-shaping Optimisation (JENO) digital engine is tuned to cancel out any rogue noise at source, with the slightly stouter network audio player featuring hi-res remastering and a generous nine digital and analogue inputs. £37,099 technics.com



LOC8TOR FOR PETS

The Loc8tor is well protected, but it's heavy and bulky, so WIRED assigned it to Bless, a gentle Rottweiler cross. It uses 3G and GPS to pinpoint its

location on a map, but the Loc8tor website is crudely designed, with no customisation, few features and no mobile app. So as Bless walked, WIRED used the iPhone's browser to follow her on the Loc8tor map. It was accurate enough, but it feels hopelessly outdated and has a steep subscription fee. **3/10** loc8tor.com

G-PAWS TRACK

The G-Paws GPS tracker was simple and small enough to attach to rescue cat Effra's collar without discomfort. It uses satellites to record Effra's movements, which WIRED downloaded on to a laptop as a GPX file. The G-Paws website integrates with Bing Maps, so WIRED could see Effra's tracks in detail with speed



and distance data, as well as a timeline. There's no mobile app and no way to locate Effra in real time if she gets lost again, but it's fascinating to see how far she travels. **6/10** g-paws.com

Ensure Rover returns

No more putting up posters of your beloved missing pet, thanks to these discrete trackers

Price £99 **Subscription** £40 per month
Dimensions 68 x 36 x 18mm **Weight** 60g
Accuracy Within 5m **Battery life** 7-10 days

Price £50 **Subscription** n/a
Dimensions 45 x 25 x 15mm **Weight** 11g
Accuracy Within 3m **Battery life** 8 hours

TEST

The *Tractive* app can log Woody's walks to share on Facebook

TRACTIVE GPS

Lightweight but robust and waterproof (right, modelled by Woody), this uses 3G and GPS data to pinpoint location, so you need to pay the subscription. An inbuilt LED can be remotely activated to find your dog in the dark, and Jodie, a lively lurcher, paid no attention to the device. We liked the feature-rich software. **8/10** tractive.com

Price €149
Subscription €5 per month **Dimensions** 51 x 41 x 15mm
Weight 35g **Accuracy** Within 5m **Battery life** 2-5 days



POCKETFINDER

This rugged GPS device is waterproof with a rubber pouch that attaches easily to a collar. WIRED used it to follow Todd, a beagle. PocketFinder relies on the EE mobile

network to show exact location but the subscription fee doubles when used abroad. You can customise the supporting mobile app by uploading a picture of your pet and set boundaries that trigger an alarm if crossed. The battery life isn't best on test, but the device is very accurate, easy to use and reasonably priced. **7/10** pocketfinder.co.uk

Price £85 **Subscription** £10 per month
Dimensions 67 x 50 x 22mm **Weight** 40g
Accuracy Within 3m **Battery life** 3-4 days

HOW WE TESTED

With help from the volunteers and residents of Battersea Dogs & Cats Home, WIRED tracked a number of animals as they explored the grounds. We attached the devices to dogs of varying sizes and noted how readily they accepted the tags and how accurately their paths could be mapped remotely. The cat, Effra, was allowed to wander at will.

NO-KEYBOARD PC

HP SPROUT RI SERIES

HP's latest desktop creativity innovation moves the all-in-one PC concept forward in two key ways: the first is an overhead arm containing a camera; the second, a detachable "touch mat" that neatly eschews both keyboard and mouse, prompting you to get hands-on instead. These technologies allow you to scan almost any item then physically manipulate its appearance onscreen in any way you wish. \$1,900 sprout.hp.com

WIRED
LOVES

The "illuminator column" also holds scanner, lamp and projector



FETISH

SPEAKERS

ANDERSON STONE

Hand-shaped from reclaimed marble (or slate, or limestone), no two pairs are identical. Two configurations are available: a two-way design built around Seas Excel bass/mid-range and tweeter drivers, and a three-way setup engineered to provide a more substantial bass response for larger rooms. The clean lines deliver a transparent point source signal and superb stereo imaging. £poa
*anderson
speakers.co.uk*



The natural rigidity of the stone reduces bad vibrations

Style choices set in stone

Marble scales down from monumental to domestic



OVERHEAD LIGHTING

LEE BROOM CHAMBER LARGE PENDANT LAMP

Part of the British designer's Nouveau Rebel collection (named in reference to the changing perception of marble as a contemporary design material), Broom's 260mm-tall Chamber pendant has a sculpted Carrara marble diffuser encased in a

lead crystal cylinder. It is intended to be suspended either individually or in clusters, and is available in multiple sizes and forms. *£tbc leebroom.com*

MODULAR TABLEWARE

ALL OF A PIECE TABLEWARE

It may resemble the world's chicest (and least practical) skateboard, but this collaboration between two Netherlands-based studios, Dana Cannam Design and Rachel

Griffin, is actually a series of tabletop pieces crafted from granite, wood and marble. When combined by concealed magnets, these textures can be used in anything from a small trivet up to a grand, dining-table centrepiece. *€poa all-of-a-piece.com*

A touch-sensitive LED can be added between modules

PHONE CHARGER

ORÉE PEBBLE 2

This second-generation Qi smartphone charger, in white Carrara, seamlessly tops up a range of

Android handsets. New to this design are an integrated, omnidirectional full-duplex microphone and CSR Audio

Bluetooth-enabled speaker for interference-free voice calls and music playback. *From £150 conranshop.co.uk*

iOS phones need an additional power "sleeve"



TIMEPIECE

GIULIANO MAZZUOLI CARRARA

Referencing its creator's Florentine roots, the marble case on this chronograph is hewn from the same stone as Michelangelo's David – the grey-veined marble from Carrara in the Apuan Alps, 100 kilometres from Florence. The case is bonded to a metal ring to improve its durability, before the precision Swiss movement and stopwatch complication

are installed. A matching white rubber band has been inlaid in the crown to make it simpler to grip and wind. *\$7,900 giulianomazzuoli.it*



The digits are raised to give the face a 3D feel



TEST

One fat wheel or two?

WIRED puts two wide-wheeled electric rides head to head to see which is best for cruising the city streets

HOW WE TESTED

WIRED enlisted the services of 23-year-old professional skateboarder Anna Kruse to test prototypes of the OneWheel and Scoosier in an urban environment. Overall handling and ease of use were assessed, as well as battery life and quality of design. WIRED's product editor, Jeremy White, was also drafted in to take both vehicles out for a test ride, despite his obvious lack of radness.

SCROOSER

So wide and stable are those rubber rollers (each an impressive 450mm x 240mm) that WIRED found they are perfect for majestic carving at speeds of up to 25kph. The Scoosier even stays upright after you've dismounted. Front disk-brakes and rear engine-brakes made stopping simple, and the turning circle was smaller than expected, considering the size of the frame. An "impulse-

drive" electric motor built in to the back-wheel hub – which means there are no gear belts or linkages to break – amplifies the force you generate when pushing off and kicks in automatically once you exceed 3.2kph. You can also run it on its electric motor, which will extend the maximum range the Scoosier can travel from 35km to 55km. WIRED found that standing was very comfortable and allowed

a much greater level of control while negotiating small paths or weaving in and out of other pavement users. Acceleration is pleasingly predictable, and at no point did we feel out of control. Kruse did have one criticism: "You would like to be able to go faster than the maximum of 25kph. But then the Scoosier would fall under the helmet law." **9/10**
From €3,336 scoosier.com



Weight 28kg **Motor** 250W (curbed)/1000W hub **Battery** Li-ion battery management system **Charging** 1.5 to 3.5hrs



ONEWHEEL

The OneWheel is effectively a hybrid of a skateboard and Segway. It uses an on-board gyroscope and motion sensors for dynamic stabilisation, so neither of the two footboards touch the ground once in motion. The electric brushless hub motor is housed in the 29cm-wide tyre, so there is only one moving part, and it can accelerate up to just under 20kph. The liquid battery in the frame lasts for about 45 minutes. On WIRED's first attempts, the sudden forward motion generated by the torque from the motor as you lean in the direction you want to go threw us off immediately. Once prepared for this, the next few rides were slow and ungainly, yet still remarkably intuitive. However, the OneWheel does require more than a little practice to get anywhere near the top speed. Once there, it feels nippy and agile. Stopping with any degree of grace was also an issue, and WIRED resorted to jumping off the board. But it is possible to cruise to a halt with just the right amount of leaning back. "It is more pleasant than a skateboard, because you don't have to push," says Kruse. Significant drawbacks include weight: at 11kg, the OneWheel is unwieldy, and the range on a single charge is just 6.5km to 9.5km. **7/10** \$1,500 rideonewheel.com

Clever compacts

WIRED's expert photographer reviews two new digital point-and-shoots



FUJIFILM X30

The X30's retro looks and abundance of filters aim it squarely at *Instagram*-loving hobbyists. The three-inch, 920k-dot tilting LCD screen makes overhead shooting effortless, while wireless image transfer (via an app) and remote camera shooting provides simple synergy between the camera and smart devices.

The X30 is a solid point-and-shoot, but some of the improvements on its predecessor also let it down, meaning this attractive, (not that) little camera may embody style over substance. **7/10** £479 fujifilm.eu/uk

Resolution 12MP
Lens 28-112mm
f/2.0-2.8

Processor EXR
Processor II
Video Full HD
up to 60fps/1920 x
1080, built-in mic,
H.264 codec



SONY RX100 III

The RX100 III may appear dainty, yet it has a gluttony of features. An OLED 1.44-million-dot electronic viewfinder is perfect for shooting in harsh lighting – while the ample photo effects and 180-degree multi-angle tilting LCD make this great for selfies.

The ZEISS lens and bright f/1.8-2.8 aperture allows you to capture as much light as possible without

having to resort to the in-built flash. Paired with its EXMOR R 20.1MP 1in sensor, images are impressive.

Irritants do exist – no touchscreen and weak battery life, for example – but the RX100 III is built to be used with ease by RAW-shooting pros

and would-be snappers alike. Style and substance. **9/10** £699 sony.co.uk

Resolution 20.1MP
Lens 24-70mm
f/1.8-2.8 **Processor**
BIONZ X **Video**
Full HD up to 1080/
60p at 50mbps
(720p at 120fps),
XAVC S codec



Tablet extra!
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app to read extended
reviews of the cameras



Weight 11kg **Motor** 500W transverse
flux hub **Battery** lithium
iron phosphate (LiFePo₄) 48V
Charging 20mins to 2hrs



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HIGH FLIERS

PHILIPS NC1

Hybrid noise-cancelling technology and low-mass design, featuring memory-foam cushions, push these to the front of the queue for reliable long-haul tranquillity. Four microphones placed inside and outside the earpiece ensure cancellation across a broad frequency range. The headset can be folded away in multiple configurations for easy stowing. £250 philips.co.uk



LOOK SHARP

ALPINE

Using a patented technology called TKR3 (Tuned Kenetic Resonance 3), the headband of these headphones transmits acoustic low frequencies to create a wider, more immersive sound field for the listener. The Level Play iOS app allows you to tinker with the headphones' five-band EQ via Bluetooth, and creates playlists based purely on each track's beats per minute. \$300 alpineheadphones.com

DEVIL'S IN THE DETAIL

NOBLE AUDIO KAISER 10U

Developed by Noble employee "Kaiser Soze" – and with each earbud containing five pairs of balanced armature drivers covering the full range from bass to super-

high frequencies – the Kaiser 10U is a universal-fit, in-ear-monitor packing some serious audio chops. The hand-finished four-way design includes detachable cables with an industry-standard two-pin configuration. £999 nobleaudio.com



HEADPHONES

FETISH

WORD ON THE STREET

URBANEARS PLATTAN ADV

A seemingly conventional – if stylish – set of Swedish headphones, the Plattan ADV has hidden depths: besides its highly

precise 40mm dynamic drivers, it includes a detachable, mic-fitted cable that can be connected to the right or left ear-cup, and an additional 3.5mm socket for daisy-chaining headsets for shared playback. £50 urbanears.com

The Plattan ADV's fabric headband is removable and machine-washable



Hold the 'phones

Improve your headspace and aural pleasure with these bespoke sonic boons

WEARABLE AUDIO TECH

ROAM ROPES

These contain a micro pendant that is part digital-signal-processing amp, part Bluetooth processor, and a six-hour battery. It memorises any changes made to its noise equalisation presets via the ROAM EQ app, allowing you to apply your preferred sound settings to whatever source you connect to. \$299 roamwith.com



POD SQUAD

Essential podcast kit

Producing your own show? Here's what you'll need before hitting the red button

▼ SOFTWARE

GARAGEBAND/LOGIC PRO X

GarageBand is almost the *de facto* standard for podcasters thanks to its friend the MacBook. For granular editing options, we use Logic Pro X. *Free/£140 apple.com*

PAGES FOR MAC, IOS AND WEB

For planning content, WIRED uses Pages, or try the cross-platform Google Docs. *Free apple.com; docs.google.com*

SQUARESPACE

Ready to publish? Squarespace is a blogging platform with built-in podcast hosting and management. *Various prices squarespace.com*

PODTRAC

Finally, for stats on who your listeners are, Podtrac's management tools are highly recommended. Keep track on download numbers and trends from around the world. *Free podtrac.com*

▼ HARDWARE

1. BEHRINGER XENYX I202FX

UK manufacturer Behringer makes extremely affordable and high-performing mixing desks for podcasters on a budget. The benefit of a desk like this is simple: it accommodates more than one microphone. *£69 behringer.com*

2. BLUE YETI PRO MICROPHONE

This USB mic has fantastically high-quality sound. It has a built-in headphone amp and direct volume controls, making it perfect if you've no time for setting up a mixing desk. *£199 bluemic.com*

3. ZOOM H5 FIELD RECORDER

WIRED uses a Zoom H5 when recording at trade shows or industry events. Not only does it have excellent built-in microphones, but you can plug external ones in too. It's worth the price if you're after top-quality sound. *£180 zoom.co.jp*

4. APPLE MACBOOK PRO

You don't need a powerful laptop to make a podcast. However, the big benefit of using a MacBook Pro is that it comes with essential software such as GarageBand. *From £899 apple.com*

5. BEHRINGER C-3 MICROPHONES

With your mixing desk set up, you need at least one of these mics (WIRED uses four). The C-3 series is good value and ideal for round-table podcast debates. *£50 behringer.com*

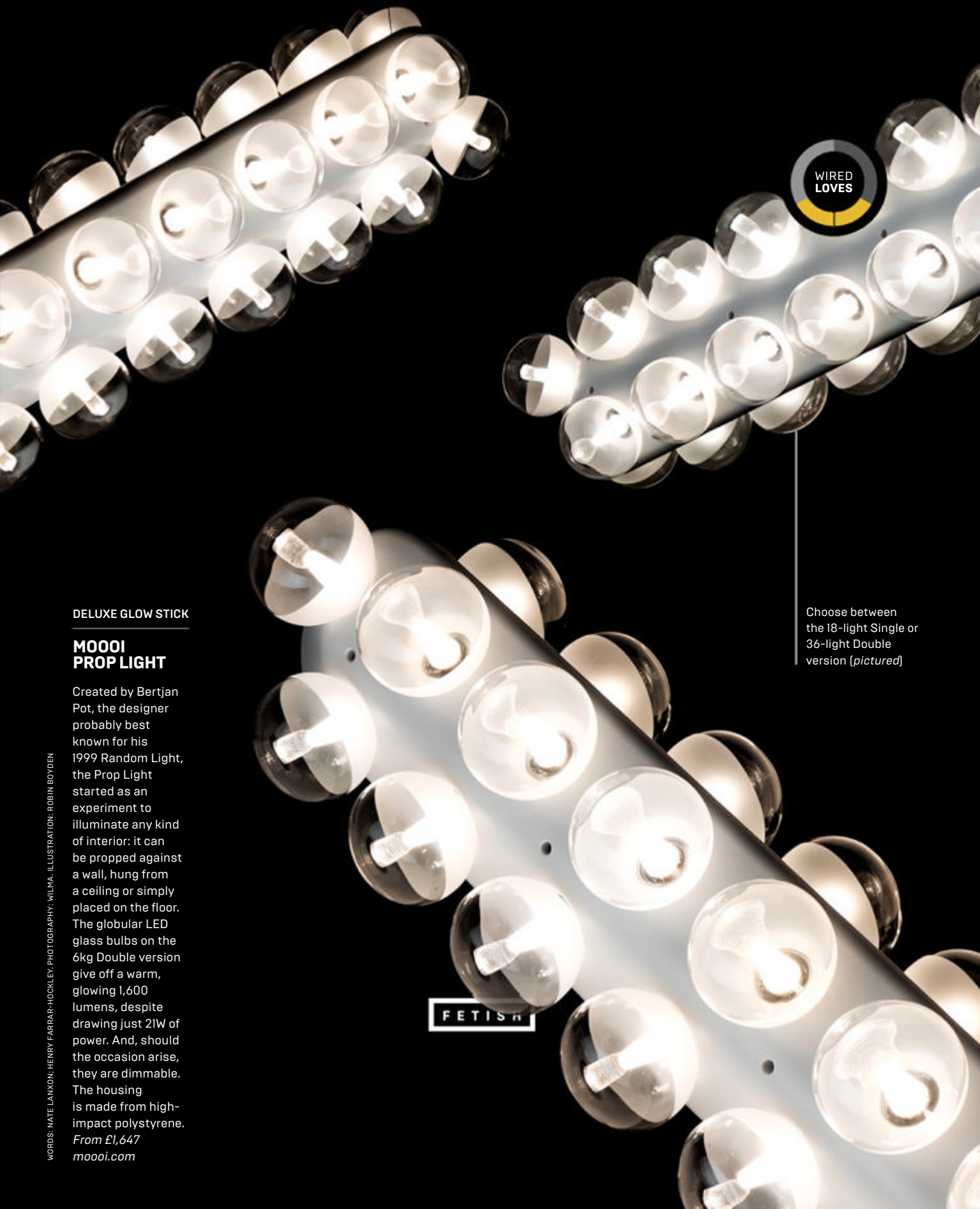
6. STAGG SMC6 CABLES

Cheap XLR-to-XLR cables (the kind required for microphones and mixing desks) can make podcasts sound terrible. Consider paying a little more and snag a Stagg. The SMC6 won't break the bank and sounds great. *£10 staggmusic.com*

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IDEAS BANK

MAELLE GAVET

The data says Google and Facebook need regulating

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hen a handful of tech giants are gatekeepers to the world's data, it's no surprise that the debate about balancing progress against privacy is framed as "pro-data and, therefore, innovation" versus "stuck in the Dark Ages". Now the issue has been turned into one where you're either for enlightenment and progress or for stifling human advancement in the name of privacy, it becomes more difficult to say: "I'm against big data."

But why should multinational corporations put our interests ahead of their own? By assuming companies can be trusted to use our data responsibly, we are complicit in the notion that self-regulation will suffice – and that we tamper with these innovators, by binding them up in regulation, at our peril.

This is dangerous. It simply isn't acceptable for the likes of Google, Facebook, Amazon and others, which amass data by the terabyte, to say, "Don't worry, your information's safe with us as all sorts of rules protect you" – when all evidence suggests otherwise.

Until the European Court of Justice created a "right to be forgotten", Google faced minimal constraints – and took little action – to protect privacy. Similarly, Facebook has repeatedly insisted on its respect for users' privacy, but from its development of facial-recognition software to the way it tracks your movements across the web, the company has incrementally made private information public.

The history of business has shown that companies usually only regulate themselves if they're forced to by legislation, or out of self-interest – often in the shape of a marketable message that will help sell more products.

Not only is self-regulation largely a fantasy, but repeated scandals across multiple industries have proved that companies are fundamentally incapable of self-regulating for the greater good.

Almost everywhere, it has taken regulators' intervention to curb the telcos' monopolistic inclinations and fondness for opaque pricing. Or take the energy giants, without which we'd struggle to heat our homes. But we would have endured far less pollution too – these companies' "sustainability" campaigns came in the wake of massive oil spills, with TV pictures of crude-oil-soaked seabirds turning public opinion – and legislators – against them.

I see no reason why tech companies should act any differently. Expecting these businesses, with their unique access to big data, not to mine it to the bottom, and beyond, is naïve. Nor should we be remotely surprised whenever they smother new market entrants.



And just as the energy corporations and telcos have innovated to improve our lives, the data these technology companies are extracting is reshaping society for the better, from medicine to retail. But there will be costs: mass data breaches instead of oil spills. As with the telcos, there will be pricing opacity.

These are the price tags of progress and innovation. But just because costs are inevitable, it doesn't mean we shouldn't confront them. Tech companies need oversight.

That's why we need to find a balance between companies, governments and individuals about data and the right to privacy. Striking a balance between innovation and regulation is complex. The last thing we need is overzealous politicians stifling the very innovation our societies crave, or indeed for companies to try to dodge or game the guidelines. But that is where the rest of us come in. It's up to individuals to demand smart, effective laws – and buy products and services from those companies striving to do the right thing.



Maelle Gavet is CEO of OZON Group, Russia's largest e-commerce group

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WENDY HALL

If you want the internet to stay a force for good, click here

Some time later in 2015, the Global Commission on Internet Governance (GCIG) is due to publish a series of research papers as part of its report on the future of internet governance. Topics will include internet fragmentation, the global economics of net neutrality, human rights online and emergent cybersecurity challenges. There is a growing demand for a sensible debate in this very complicated, but increasingly important, area.

Tim Berners-Lee, the inventor of the web, has called for a Magna Carta for the internet as part of his Web We Want campaign. Last spring marked 25 years since Berners-Lee developed the web using the same

principles on which the internet itself was founded, namely that it was decentralised in architecture, that its standards and protocols were open and free, and that their evolution was organised democratically by those most involved in their development. These principles have led to the web we know and love. But they are now under threat from governments and corporations as the web becomes even more significant in our lives.

We will hear a lot more about personal data, privacy, security and trust. The open-data movement has brought an increased awareness of the power of data for innovation, but not all data can be made open, and there are major ethical and moral issues facing society in terms of how we should handle the massive amount of personal data that we are all generating. Health data is one obvious example – but we are increasingly hearing about unauthorised experiments being run by social-network companies on the data they hold about users. Such experiments must be subject to accepted ethical practices, but



Wendy Hall is a professor at the University of Southampton and a founding director of the Web Science Trust

how do we go about establishing the necessary regulations and standards across the world?

What are our rights in terms of internet access? And who has what rights to do what with our data? As Edward Snowden's revelations about the NSA have proved, governments are preoccupied with what citizens are getting up to on the internet, and with the fact that they have little control over either us or the global network that has self-evolved to become the dominant way in which those of us who are connected access information globally. A separate European internet has already been proposed amid questions about US dominance in this space. China makes much of freedom of access for its citizens, while monitoring everything they do. Emergency legislation is being enacted without consultation to ensure appropriate checks and balances are put in place, and governments are failing to agree on basic issues such as net neutrality. Berners-Lee's proposed Magna Carta will be one way of trying to ensure that the internet remains, as it was originally intended, a force for good in humanity.

We have begun the journey. In June 2014, the United Nations published a report entitled "The right to privacy in the digital age". It stated "there is a clear and pressing need for vigilance in ensuring the compliance of any surveillance policy or practice with international human-rights law, including the right to privacy, through the development of effective safeguards against abuses".

We can only take the Magna Carta analogy so far. If governments are King John, that would make corporations the barons. But who will represent the rest of us, the users? That's something we all need to ask as 2015 gets underway.



CHARLIE BURTON

Crowdfunding is getting more crowd pleasing

When a recent startup announces a multi-billion-dollar buyout, its backers normally open the champagne. But Oculus VR, which makes the Rift virtual-reality headset and was acquired by Facebook for \$2bn (£1.3bn) last March, found its investors decidedly unhappy. “I feel cheated. I backed a vision of what I wanted gaming to be in the future. Now all I want is my money back,” commented one on the company’s web page. The reason for their bile, beyond suspicions about Facebook’s suitability, was simple. The backers had raised \$2.4m for Oculus through the crowdfunding platform Kickstarter. Although at the time they’d received T-shirts, posters and developer kits in return, they wouldn’t see a penny from the sale.

If the investors had asked for equity to the value of the £190 headsets that some received, they could have made as much as £25,000. Those numbers caused no little anxiety in the Kickstarter community and this, in

turn, helped spur interest in another form of crowdfunding, known as crowd equity (or “hyper funding” in Valley speak). In return for capital, backers are given a slice of the company. If the company does well, they might get a dividend or, as is more likely, profit from an acquisition.

Last year, crowd equity was the most marginal type of crowdfunding, but it’s about to surge. Plus, when the US government puts Title III of the Jumpstart Our Business Startups (JOBS) Act into effect this year, non-investor-accredited Americans will legally be able to take part.



Charlie Burton, a former WIRED associate editor, is the commissioning editor of GQ

In the UK, crowd equity is already legal and there are a handful of platforms now available – Crowdcube.com, say, or BankToTheFuture.com, which is about to move out of beta. Seedrs.com is the most well-established, launched by Jeff Lynn and Carlos Silva in 2012. Their inspiration? Charles E Merrill, who founded Merrill Lynch, and was convinced the stock market should be accessible to ordinary investors, not just the super rich. Seedrs allows investors to put as little as £10 into a diverse range of startups, and so far over 6,000 people have done just that in return for an agreed amount of equity. The platform has financed 125 companies at time of writing; 80 of those in 2014.

For investors, one of the main selling points of crowd equity is that it strips out the legal work. Traditionally, investing less than around £10,000 was not worthwhile because the lawyers’ fees could be as much as £2,000. As a result, however, it was assumed bigger investors would not have much incentive to get involved in this new approach. But crowd-equity services such as Seedrs are finding quite the opposite. This type of platform helps good VCs pick good business, and the bad VCs – who were never adept at picking businesses, but did well because they were, once upon a time, the only source of funding – should start to fall by the wayside. Here’s hoping.

DAVID GELLES

Omm... (and other smart things to say at work)



David Gelles is the author of *Mindful Work: How Meditation is Changing Business from the Inside Out* (Profile Books, £9.99)

There’s a reason they call it work. Long hours on the job – even a job we love – take a toll on us. But it doesn’t have to be this way. The office can also be a place where we recharge our batteries, rejuvenate our spirits and even heal our bodies.

A growing number of both small businesses and multinationals are

creating the space for this new way to work. They are offering yoga, meditation and mindfulness training to develop their employees’ well-being, along with the bottom line.

Mindfulness – an ancient awareness practice enjoying a renaissance – is fomenting a quiet revolution in the business world. When workers become more mindful, they make better choices

on the job and in their personal lives. That trickles up to employers, creating more efficient workflows, a more focused workforce and healthier employees.

At General Mills, executives are meditating in the conference room, trying to become more compassionate leaders. And at Salesforce.com, employees are using mindfulness to cultivate self-awareness, zeroing in on qualities – patience, focus, clarity – that they want to improve in themselves.

Right now, the companies teaching mindfulness, meditation and yoga in the office represent a small but potent minority of the corporate world. That’s no surprise. Western business culture values profits over purpose, and efficiency over equanimity. Even as the benefits of meditation are made clear

through a raft of scientific and academic studies, some companies may resist.

But thanks to the public embrace of mindfulness by a growing list of type-A business leaders, including the head of Ford and the CEO of LinkedIn, what was once considered a pseudo-spiritual sideshow is now part of the corporate mainstream. Mindfulness is being taught at Harvard Business School, and being practised in the halls of the United States Congress.

Many companies already use the “triple bottom line” to assess their holistic impact on the world. Now, in addition to looking out for profits, their impact on society and their effect on the environment, some businesses are adding a fourth dimension. They are looking out for the emotional and physical well-being of their employees.

A growing body of research into mindfulness and meditation is demonstrating their efficacy. It turns out that sitting in silence can rewire our brains, making us less reactive, more focused and even kinder. And, although meditation is an exercise for the mind, it's also surprisingly beneficial for the body. Mindfulness appears to strengthen the immune system, and even promote weight loss. At Aetna, the American insurance company, after employees adopted mindfulness and yoga, healthcare costs dropped noticeably.

Profits and operating efficiencies, however, are not what mindfulness is all about. For employees, embracing it offers an opportunity to become clearer and kinder on the job. And for employers – who want to attract new talent, retain high performers and foster innovative cultures – offering mindfulness, meditation and yoga in the office means the chance to give workers more than just a pay cheque.



Christopher Stevens is the author of *Written in Stone: An entertaining time-travelling jaunt through the Stone Age origins of our modern-day language* (Virgin Books, £12.99)

CHRISTOPHER STEVENS

Your laptop is 8,000 years old

Ever felt like hitting your computer? Or wrestled with an app that was apparently coded by a caveman? Take comfort from the fact that most technical jargon is derived from Stone Age words that existed thousands of years before even writing, never mind microchips.

A laptop, for instance, is named using two syllables that date back to a neolithic tongue known as Proto-Indo-European (PIE). These early farmers, who probably lived on the Eurasian steppes of what today is Russia, developed the monosyllables that act as the building blocks of most modern languages.

One of these words was *lab*. It means “hanging”, like a lobe or flap. In early English, the skirts of a dress or coat, the hemmed part, was the lap or lappet; it could also be the hanging part of an apron, covering the upper legs – the part we now call the lap.

In PIE, “top” meant a precise place, somewhere that could be pinpointed, such as the highest piece of ground. “Top” has given English lots of place words, such as topography, the study of localities, and utopia, literally “no place”.

A laptop, then, is just two ancient sounds bashed together like a couple of chunks of rock. A farmer 8,000 years ago would have had no trouble recognising the words, even if the finer nuances of C++ might have foxed him.

The nomads who settled and built the first homesteads also made a discovery that gives us the word for a 21st-century plague: the computer virus. Stone Age man realised tribes that built villages near swampy ground suffered from diseases such as malaria.

The PIE word for damp ground is “weis”. That became the Latin word “uirus”, which was the poison sap of plants that grew in mud. By medieval times, “uirus” was pronounced “virus”.

This neolithic language possessed viral qualities of its own. The monosyllables could be used as verbs, nouns or adjectives: we don't understand



PIE grammar because it was never written down, but the way it pervades everything, including Icelandic and Hindi, is testament to its effectiveness.

Think of PIE as the DNA of modern language, the core code. It spread like a fire across Europe and Asia (exceptions such as Basque, a non-PIE tongue that survived in a pocket of the Iberian peninsula, are rare).

For computer programmers, this has a massive implication. The most successful language in millennia consists of flexible blocks fitted together in infinite shapes, and the meaning can always be traced back to the root.

Take “memory”, which is at the heart of computing. It comes from two PIE syllables, “men” and “mor”. “Men” is the “mind”, the silent thought process. “Mor” is “grief”, a syllable found in morbid, mourn and mortuary. Together, “memory” is literally “grief of the mind” – very apt if your hard drive crashes and you haven't backed up.

This rule also applies to invented languages that run our machines too. To be most effective, the code must grow by accretion. It will be robust only if it can be run backwards and broken down into its smallest components.

An artificial language, where segments consist of arbitrary groups that are manufactured rather than built up, will not survive. Something better will come along and destroy it. A caveman could have told you that.



PICTET – FROM
NEW MONEY
TO OLD MONEY



"We're the largest independent private bank in Switzerland, and one of the largest asset managers in Europe, with over four hundred billion dollars of assets under management and custody," said Agnes de Guzman, senior private banker at Pictet, at the event. The bank, which sponsored WIRED's *Europe's 100 Hottest Startups* guide, is paying close interest to the startup economy – a position neatly summarised by de Guzman quoting her favourite Pictet advert: "Entrepreneurs make new money. We protect it until it becomes old money."



Shoreditch's Second Home innovation hub was the venue for an evening of discussion and debate, as Pictet and WIRED celebrated Europe's 100 Hottest Startups – with help from leading London entrepreneurs

An evening to celebrate startups



To launch WIRED's *Europe's 100 Hottest Startups* supplement, produced in association with Pictet (WIRED 09.14), WIRED and Pictet co-hosted an evening event at London's Second Home workspace in November. Joined by some of Europe's most successful entrepreneurs, investors and innovators, the aim of the evening was to network, debate and raise a glass to the array of disruptive growth-stage businesses across the continent.

"When we say hottest, we don't mean the best funded or those with the highest valuations – we mean those that are causing a buzz at the moment," explained WIRED editor David Rowan, on stage.

Such startups include Barcelona's AI customer support platform CogniCor, carpool app *BlaBlaCar* from Paris, marketing software company Ometria

from Moscow, and Tel Aviv freelance hiring tool Fiverr.

The London businesses present were equally impressive. Founders from payments app Yoyo, pop-up rental platform Appear Here, money transfer service TransferWise and others were in attendance. Chris Morton, cofounder of e-commerce site Lyst, joined Rowan for an informal chat about the startup scene. Topics covered included London's strengths as a startup hub and Morton's experience of the business taking over his life – an outcome Agnes de Guzman, senior private banker at Pictet, knows well.

"Successful entrepreneurs prefer to focus on their business – high risk, high growth are more interesting and more exciting than the daily management of their liquid wealth," she said. "Understanding their needs is key." For more, see perspectives.pictet.com





Opera's scene- change

LA SCALA, THE TEMPLE OF ITALIAN OPERA, IS EMBRACING TECH TO REACH NEW AUDIENCES. WIRED TAKES AN EXCLUSIVE PEEK BEHIND THE VELVET CURTAIN ➤

S

ince 1778, La Scala in Milan has been regarded as one of the world's most prestigious opera houses. Until now, La Scala has long kept many of its inner workings a closely guarded secret – but with opera struggling to attract younger audiences, it is turning to technology to promote openness and broaden its appeal. “To modernise means to communicate opera’s universal value and make it suitable for the audience of today,” says stage engineer Franco Malgrande, 59. Among the changes: launching lascalaunder30.org, a website for under-30s, and using social media to liveblog performances and show new works during production. Translation screens in every seat allow non-Italian speakers to follow the music. “The internet and social media are also a good opportunity to show what happens behind the scenes,” says Malgrande.

Completely remodelled in 2004, today the backstage is almost entirely computerised, allowing for more elaborate

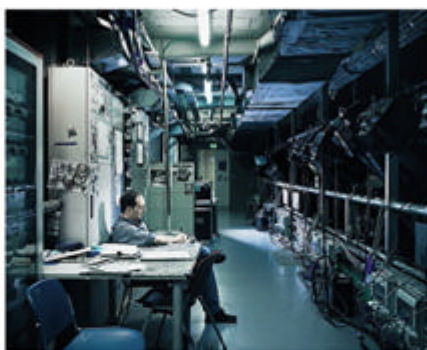
Below: the completely overhauled lighting rig allows for more complex audiovisual performances



multi-media performances. Shown on the previous spread is the rigging loft above the stage, with its complex system of 150 computer-controlled motors and winches that move the stage scenery 40m below. The stage itself is also controlled: a central 20m x 18m area is made up of 15 sections which can be moved vertically or horizontally mid-scene (the winches are silent, so as not to interrupt the performance).

Malgrande's biggest challenge for 2015: *CO₂*, a new opera by Giorgio Battistelli, debuting in May. ("It's a very contemporary staging, with many videos and quick scene-changes – similar to a TV show.") Such shows, he hopes, will ensure opera's future. "Once [young people] know the opera world, they're often very enthusiastic," says Malgrande. "They just need the appropriate communication." **OF** *teatroallascala.org*

OPENING SPREAD PHOTOGRAPHY: MATTIA BALSAMINI



High above the stage

A stage technician takes notes in the redesigned lighting area, on a galley 20m above the stage



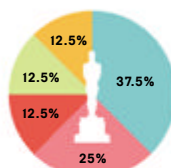
Scenery waiting and ready

Scenery for Verdi's *Simon Boccanegra*. La Scala can now stage 120 shows per year, up from 80



Backstage access

Stage assistants scale these staircases to reach the gangways to operate the lights and pulleys



DUBIOUS DATA

OSCARS FAVOURITES ANALYSED



Troubled British scientists

(*The Theory of Everything*, *The Imitation Game*, *Interstellar*)



Murder

(*Gone Girl*, *Foxcatcher*)



Batman!

(*Birdman*)



Civil rights

(*Selma*)



Really, really long filming schedules

(*Boyhood*)



Actors in the driving seat

Filming speedy car

chases is tricky. Take close-ups: directors used to be restricted to using an actor with a fake steering wheel on the right of a left-hand-drive car, while a stunt driver sat out of view.

But for new BBC series *The Interceptor*, film-makers used a stunt pod: a cage fixed to the roof of the car that gives a driver control of the vehicle from above.

"The acceleration, steering and clutch are all on the roof, with wires that run down the side of the car," says stunt co-ordinator Andreas Petrides. Although the cage has been used in films such as *Skyfall*, it has only recently found use in British TV shows. It allows for more realistic chases, including shots of actors "driving".

Such a set-up isn't easy: "That top-heavy weight means you have to re-rig the whole car so it can take an extra 200kg," says Petrides. "The Hyundai Sonata we used had to have wider axles, bigger wheels, reinforced suspension and a retuned engine."

The sequence itself, which was shot on a closed-off duel carriageway in Silvertown, London, involved 16 stunt drivers – most making up traffic – and actors Robert Lonsdale and Paul Kaye, who had to rehearse keeping in sync with the driver above. "It frees them up to act with each other," explains Petrides. "It looks great. Audiences now expect movie quality on TV, so we have to push the boundaries." **Stephen Kelly** *The Interceptor* starts on **BBC One** in March



Monster mashup

What do you get when you cross Godzilla with a squid? Ask *Evolve*...

Creating an iconic monster isn't easy: for every King Kong there's a Sharktopus. But for *Evolve*, Turtle Rock Studios' first major new title since the best-selling *Left 4 Dead*, the California-based developer wanted to create a creature that was both memorable and adaptable.

The game takes place on the planet Shear, where human settlers are being terrorised by alien creatures. Players work together as a team of Hunters (pick from medic, assault, trapper and support classes) – or join the baddies as one of three species of monsters with power-up abilities: Goliath, Kraken or Wraith. (If you pre-ordered the game, you get a fourth monster, Behemoth.)

However, early designs for the beasts proved not monstrous enough: "We had these very abstract looking creatures," says Phil Robb, 44, Turtle Rock's cofounder and creative director. "In the game, you didn't know what you were looking at."

So the studio turned to monster archetypes and the natural world: Goliath, a fire-breathing reptile (*main image*), references, among other beasts, gorillas via classic creature Godzilla. During gameplay, the monsters can adapt and enhance their abilities to make the most of their environment – or just overpower the humans.

"People have pointed out that what the monster does is not actually evolution – it's metamorphosis," says Robb. "The word 'evolve' plays more into the idea that you have to change in order to meet the various challenges – you evolve your strategy." **Daniel Nye Griffiths** *Evolve* is out for Xbox One, PlayStation 4 and PC on February 13

1



Goliath

A close-quarters combat specialist, Goliath can eject fiery liquid from its mouth

2



Wraith

A female monster, Wraith was inspired by cobra snakes and the praying mantis

3



Kraken

The electric-powered Kraken shares physical traits with both Goliath and Wraith

GOLIATH IS
AVAILABLE AS
A 3D-PRINTER
FILE



SMILEY LIKE YOU MEAN IT

Emoji can express surprising subtlety, from innuendo (🍆) to sarcasm (🙄) – but are such sprites art? New York-based startup Hi-Art thinks so. Founded by illustrators Nico Ponce de Leon Dios and Paul Lafreniere, their app lets artists create their own interpretive artworks for third-party keyboards – the "Back soon!" sign above is by Kaput.

"Like so many people, I wondered why emoji weren't more diverse or dynamic," says Dios, 34.

Hi-Art includes some iconic masterpieces – from Vermeer to Warhol – but it's particularly popular with street artists, and has launched collaborations with musicians such as Jason Derulo and Ghostface Killah. (The app is free, but illustrators can charge a fee for their work.)

But how does one paint a picture intended to express far more than 1,000 words ever could? "The artist is often unaware how their images will be used to communicate," says Dios. "Rothko's colour fields would not be ideal, whereas an expressive Lichtenstein might be perfect. The concept of artwork to replace sentences or express emotion has led to some really interesting things." And yes, there is an emoji *Mona Lisa* – just don't expect the recipient to know what her mysterious smile means. **OF hi-art.me**

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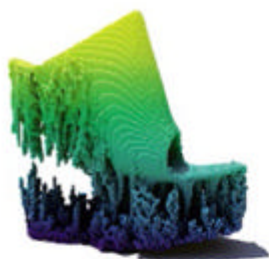


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FOOT + PRINT = FASHION

Francis Bitonti

doesn't create clothes: he gets algorithms to do that for him. The Brooklyn-based designer plays with mathematical models and 3D printing to create spectacular accessories that would never come out of an Italian fashion house. Take his pixelated high heels (*above*), generated using John Conway's Game Of Life – a mathematical model for cell division. The heels are printed using a Stratasys machine; the graduated blue-green hues are achieved by blending different filaments.

Bitonti, 31, originally created the shoe for Adobe, but is now working with footwear manufacturers to release the design. "We're focusing on 3D-printing the wedge, combined with a more traditional upper," he says. "It's more comfortable that way."

This month, Bitonti will release a line of algorithmically designed womens' accessories such as bags, earrings and cuffs. "We haven't even begun to see the range of materials we will create with 3D printing," he says. "The majority of the material problems we face right now are software problems."

OF francisbitonti.com

PHOTOGRAPHY: ZEN SEKIZAWA

Music's in their DNA

HOW OK GO RECORDED THEIR
ALBUM AS GENETIC CODE

For Damian Kulash, lead singer of OK Go, writing a song is a bit like creating life: "Playing around with the primordial soup of sound, and waiting for that spark." The LA quartet are best known for creating elaborately choreographed music videos, but for their latest project, they are working with UCLA biochemist Sriram Kosuri to encode new album *Hungry Ghosts* as DNA. "The spirit of everything we do is to find a sandbox and see where the edges are," says Kulash, 39.

Kosuri's lab will convert the zeroes and ones of the digital file into the genetic code of Cs, As, Ts and Gs that make up DNA. It will be created in an electrophoresis machine; fans will be able to buy a vial containing a few nanograms dissolved in water. They can then sequence the code and convert it back into a music file. And, because of DNA's size, a few drops could contain hundreds of thousands of units. "It would be fun to break sales records by selling a single vial,"

Kulash says.

There are still hurdles to overcome – US regulations on selling DNA for one, and the challenge of crunching all that data into genetic code. (Kosuri's lab, which previously converted a novel into DNA, is producing a paper on the project.) Then there's the hopeless task of convincing *Billboard* to recognise DNA as a sales format.

So why not just stick to videos? "It's become chic to say that nerds are the new rock stars," says Kulash. "That being said, I guess we're just nerds."

OF *Hungry Ghosts* is released on Feb 16 okgo.net



M

Most people's origami talents don't stretch further than a paper plane; Ilan Garibi, however, uses it to build sculptures. The 50-year-old Israeli artist has been creating intricate sculptures from paper for 39 years, and is now broadening his horizons by using wood and metal. "It became a quest for me to try and find as many materials

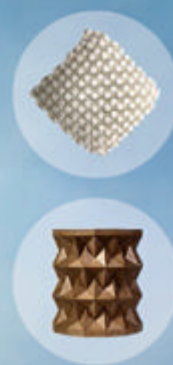
as possible that are not naturally folded," he says. "Then I try to fold them."

Bending metal ordinarily requires Hulk-like strength, so Garibi uses a laser cutter to slice into the sheet just deep enough along the fold line to allow him to manipulate it with his bare hands [gloved, to avoid fingerprints]. "You can fold almost any kind of material," he says.

"Just look at it long enough and you'll find the right way to fold it."

Garibi's *Infinity Wall* (main picture) is a 46-metre-long structure of folded metal displayed at Bavl Park in Tel Aviv. After two weeks of planning, Garibi and his team assembled it out of 26 1mm-thick stainless-steel plates.

Next up, he's working on a new installation for a hotel in Tel Aviv, and is expanding his origami jewellery line. A paperless future beckons. **SE** www.garibiorigami.com



Garibi's *Cube Tessellation* (top) has 1,000 folded corners; *Tavolini* is his range of metal and wood tables

New angles in origami

You can keep your paper: Ilan Garibi hand-folds metal and wood on a grand scale



Back from the future



CHARTED

THE 50 SHADES OF GREY EFFECT

With the film of E L James's *50 Shades of Grey* out on February 14, Amazon publishing data shows just how the series has, ahem, stimulated the erotica genre in recent years.



2011
2,696



2012
5,095



2013
7,027



2014
7,086

YEAR

Number of
paperbacks tagged
"erotica" published

Sci-fi fans have dreamt of floating on hoverboards since they featured in *Back to the Future Part II* in 1989. But when Greg Henderson finally built one, the plan was never to ape Marty McFly: he wanted to levitate buildings. "We can save lives and properties with this technology," says Henderson, cofounder of California-based startup Arx Pax. "It's a means of decoupling a structure from the Earth to allow it to survive floods and rising sea levels."

Arx Pax's patented Magnetic Field Architecture creates lift using the circular and electric eddy currents generated when a magnetic field is moved relative to a conductor. The currents create their own magnetic field which, when moved over non-ferromagnetic surfaces such as copper and aluminium, create lift. To demonstrate the technology, Henderson created the Hendo Hoverboard. It uses four disc-shaped "hover engines" embedded with magnets; steering is achieved through algorithms that redirect the board's power based on positioning feedback from onboard sensors. (Ex-professional skater Tony Hawk tested it on the company's in-house copper ramp and is a fan.) A developers' kit will launch



Above: the \$10,000 Hendo Hoverboard attracted double its intended Kickstarter target of \$250,000

Left: the *Back to the Future Part II* board

in July, with an on-sale date planned for October 21, 2015 – the date to which McFly time-travelled in the movie.

Arx Pax is experimenting with lower-cost surfaces such as conductive concrete, polymers and graphene; two hover-engine models Henderson describes as "potentially less stable, but more fun"; and a sit-down version for the risk-averse.

But the board is really just a demo: Henderson, a trained architect, wants to

license the technology to the manufacturing, healthcare and transport industries. Think earthquake-proof operating theatres, or being able to move contaminated medical waste without it touching the floor. Sounds far-fetched? So did pulling a levitating 360. "Not being a physicist," says Henderson, "I didn't know it was supposed to be impossible." Wheels? Where tech's going we don't need wheels... **Liat Clark** arxpax.com

Superwoman turns comics into movies

GOLDMAN REINVENTS SPIES IN KINGSMAN



S

o you're a fan of *Kick-Ass* and *X-Men*? That means you're also a fan of Jane Goldman. Not only is she married to noted comic-book aficionado Jonathan Ross, Goldman is also the screenwriter behind every comic book

turned Matthew Vaughn-directed movie. The pair first teamed up in 2007 on an adaptation of Neil Gaiman's book *Stardust*, and in January the partnership continues with *Kingsman: The Secret Service*, about a London street kid recruited as a super-spy. Think Harry Potter by way of James Bond. As with those other flicks, don't expect a movie that's overly faithful to the source material.

"There are always going to be changes between the page and the screen," says Mark Millar, who wrote the *Kick-Ass* and *Secret Service* comics. "But with Jane and Matthew, they're in the service of the story."

So what kinds of changes make a solid adaptation? "It's keeping the source material alive while making something movie-shaped," Goldman says. "I like it when characters respond to things that are outrageous and movie-like in an authentic way." Her scripts revel in those juxtapositions, like superheroes discussing breakfast cereal (*Kick-Ass*): "It's reversing expectations."

Among her next projects is an adaptation of *Rebecca*. Daphne du Maurier's Gothic novel helped Goldman realise that women could write, she says – and not just Austen-like love stories but genres such as horror and mystery. Add kick-ass comic adaptations to the list. **Bo Moore** *Kingsman: The Secret Service* is in cinemas January 29

PHOTOGRAPHY: JAMES DAY. HAIR AND MAKEUP: CAMILLA HEWITT

BAM! POW! ZAP! HOW GOLDMAN SUBVERTED YOUR EXPECTATIONS



STARDUST

Goldman lightened Neil Gaiman's dark novel by adding a transvestite pirate.



KICK-ASS

Goldman was hired to flesh out Hit-Girl – a sweet, C-bomb-dropping 11-year-old.



X-MEN: FIRST CLASS

Goldman's Mystique (Jennifer Lawrence) is a shape-shifter with body issues.



KINGSMAN

The latest film skewers British spy classics with foul-mouthed ultraviolence.

Colin Firth's spy Harry Hart leaves Mr Darcy in the dust

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Suzy Menkes, International Vogue Editor

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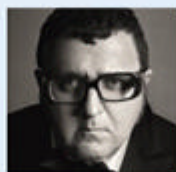
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ANTOINE ARNAULD
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Artistic Director, Lanvin



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Do the robot

THINK YOU CAN DANCE? PETER HOLDEN'S MECHANICAL ENSEMBLES KNOW ALL THE MOVES

R

ather like a contemporary Doctor Frankenstein, Peter Holden makes disembodied limbs dance on his command. The Leipzig-based British artist attaches body parts to a mechanical frame and programs their movements using a computer, to turn his sculptures into animations. "I had this idea of building a kaleidoscope of human body parts, and then I thought I could attach mechanical parts to it," explains Holden, 44. "The whole idea was quite grotesque – but it's what you do to it that makes it become beautiful."

In *SoleNoid* (above), eight tap-dancing shoes controlled by electro-mechanical valves stamp and brush out a composition by Holden's musical collaborator Marko Wild. The effect is both haunting and playful, like watching a robotic version of *Riverdance*. Another piece, *Arabesque*, is

a ballet of disembodied legs and hands – the limbs are made of polyester and fibreglass, and are modelled from Holden's own. ("It's actually really hard to find a leg when you need one," he says.) In both cases, pre-programmed movements are controlled by computer-connected pneumatic pumps that are built into the sculptures; these release bursts of compressed air from cylinders. It takes Holden at least a month to choreograph the sequences, which he then writes into a piece of software.

His most complex creation, *Vicious Circle*, is a 5 x 4 x 1.5m installation of eight metal figures with human hands moving in sync to Sergei Prokofiev's



The installation covers about 5m² and takes three days to set up



Dance of the Knights. Arranging the choreography was painstaking work: each hand required its own mechanism and contains six cylinders, and every cylinder has four points of adjustment (to control velocity). "To be able to adjust all these cylinders so that during the sequence each figure was identical in its movement was really extreme," he says. "Because of the limitations with this technology it isn't possible to do it perfectly. There is always an element of error."

His latest project is *Autogene* (on show at the IFVA Festival in Hong Kong until March 3), which replaces the limbs with eight umbrellas moving to the tune of "Singing in the Rain".

Robots: gotta dance.
Sophia Epstein
[peter-william-
holden.com](http://peter-william-holden.com)

Tablet extra!

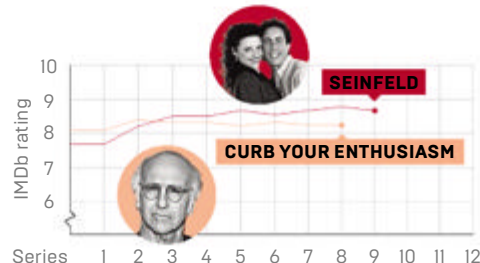
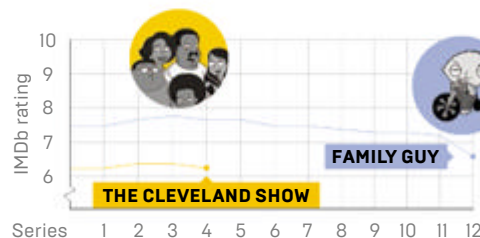
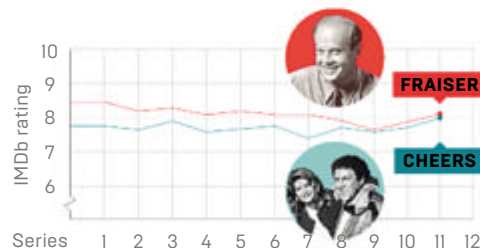
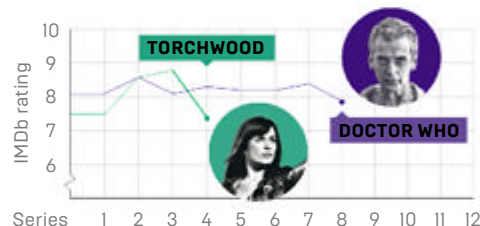
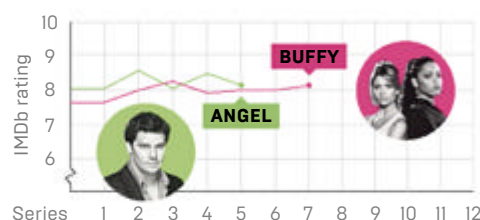
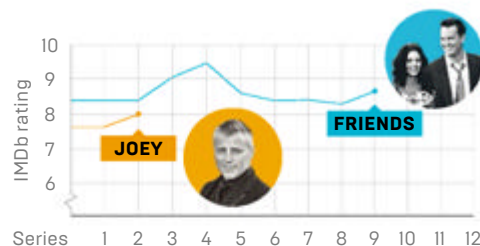
Download the WIRED app to see a video of *SoleNoid* dancing

WE PREFERRED THE ORIGINAL...

WIRED RATES THE SPIN-OFF OFFSPRING OF SUCCESSFUL TELEVISION SHOWS

The TV spin-off is making its big comeback. In February, *Breaking Bad*'s wise-cracking criminal lawyer Saul Goodman returns with *Better Call Saul* (airing on Netflix in the UK, it's set in 2002, six years before the start of *Breaking Bad*). That's not all: there's *Captain America/Marvel's Agents of Shield* love-child *Agent Carter*; a *Walking Dead* series that's not based on the comics (rumoured to be a prequel set in Los Angeles) due later in 2015; and we're not even going to start on *Girl Meets World* (you'll need the Disney Channel, Topanga fans).

Fans are right to be nervous. With rare exceptions (step forward, *Frasier*), spin-offs are usually slammed as shadows of their former selves – with disastrous *Friends* spin-off *Joey* typically used to support the theory. But what does the data say? WIRED combed through IMDb ratings to compare how notable spin-offs fared next to their parent shows. The verdict? There's still hope. **Stephen Kelly** *Better Call Saul* starts in February on Netflix bettercallsaul.com



Playlist



◀ FRESHEN UP

Ditch that room-sized humidifier: this bottle-sized creation from Korean design studio II+ is powered by USB and fits in your carry-on luggage. On a generous note, a portion of the profits go to water sanitation charities. elevenpl.us



▲ CHOPIN CHARTED

Pianogram, by software designer Joey Cloud, visualises famous pieces of music from Beethoven to Chopin based on their most-used notes – and gives you the chance to upload your own compositions. joeycloud.net/v/pianogram

076 / **PLAY** / CULTURAL PICKS OF THE MONTH / 03.15



▲ THE CROSSOVER COLLECTIVE

Music/art collective Future Brown – NY-based producers Daniel Pineda, Asma Maroof, Fatima Al Qadiri and J-Cush – mash up genres and vocalists with unique results. *Future Brown* is out on February 23 on Warp Records. futurebrown.com

▶ GLITCH ART GETS REAL

Australian artist Paul Kaptein plays on the modern trend for 3D-printed glitch art with this painstakingly hand-carved, wooden sculpture of a monk. Try and match that with a Makerbot. paulkaptein.com



▲ DESIGNED FOR LIFE

In *Furniture: Furniture That Transforms Space*, Anna Yudina records how architects and designers, such as Shigeru Ban and Bureau Spectacular, are transforming the very nature of how we use the space around us. Out on March 10.



▲ SCI-FI SECOND COMING

The Wachowskis return to creating vast sci-fi universes with *Jupiter Ascending*. Expect intergalactic royalty, half-human, half-wolf Channing Tatum and plenty of stunning visuals courtesy of British studio Framestore. Out February 6.

◀ SURREALIST SNAPPER

Photographer Niko Luoma exposes negatives to lines of light hundreds of times, resulting in eye-catching geometric prints. At London's Atlas Gallery from February 5 to March 21. nikoluoma.net



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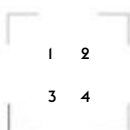
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Events, new products and promotions to live the WIRED life

Compiled by
Florian Singhoff



1/Tom Ford Velvet Orchid & Grey Vetiver eau de toilette

Velvet Orchid transforms the essence of the iconic Tom Ford Black Orchid into a feminine fragrance lavished with notes of cool citrus, floral petals, honey and rum. Tom Ford Grey Vetiver eau de toilette continues to capture the menswear philosophy of the brand – timeless style. **Front £102, rear £68**
tomford.com

2/Tobacco Dock London's new startup incubator

Tobacco Dock, home of the WIRED and WIRED Next Generation events, is launching Europe's largest startup incubator and co-working space in April 2015. The Dock is a 3,716m² section of the Grade I listed building, renovated and refitted as a unique environment for dozens of startup business. tobaccodocklondon.com

3/Sonos PLAYBAR speaker

PLAYBAR brings immersive hi-fi sound to your TV and can play music from multiple sources – such as your phone, tablet or computer – via a wireless connection. Sonos' focus on audio quality and understated design has earned the US company fans around the globe. **£599**
sonos.com/playbar

4/Diplomático Reserva Exclusiva rum

Diplomático Reserva Exclusiva is made by a family-owned rum producer in Venezuela. The blend is 80 per cent heavy-pot-still and 20 per cent column-still rum. Matured in American white oak barrels for 12 years, the blended rums have a complex, decadent profile. **£39.95 70cl**
thewhiskyexchange.com

WIRED INSIDER'S PICK OF UPCOMING EVENTS

WIRED HEALTH

Hosted at 30 Euston Square, the home of the Royal College of Practitioners, WIRED Health is back for the second year. Delegates will hear from over 40 industry leaders and growth-stage companies from the fields of medical technology, software and services. **24 April 2015**, wired.co.uk/health15

WIRED MONEY

2015 is WIRED Money's third year. The one-day event welcomes more than 20 Main Stage speakers to discuss and debate the digital disruption of money, banking and finance. The Startup Stage is a platform for new companies in the sector to share their insights. **July 2015**, wired.co.uk/money15

WIRED 2015

WIRED's two-day flagship event gathers some 800 delegates and more than 50 speakers to explore the WIRED world. The 2014 event featured will.i.am, designer Ron Arad and 23andMe's Anne Wojcicki alongside a packed roster of other influencers. **October 15-16**, wired.co.uk/15

WIRED RETAIL

Our one-day event exploring the digital disruption of retail returns for year two. The 2014 event included Intel's chief futurist, Brian David Johnson and Etsy's VP of business development, Nicole Vanderbilt. 2015's event will have more than 30 speakers across two stages. **November 19, 2015**, wired.co.uk/retail15

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HOW TO



Build your own planetarium

When teaching astronomy, California-based science teacher John Krieger wanted to show his students the stars. "In the classroom, we're stuck indoors and it's daytime, so I have to try to describe things," he says. Yet the standard displays at commercial planetariums lacked the educational content he was looking for. So Krieger built his own. "You have complete control over the sky, which is a wonderful thing for a teacher," he explains. Here's how you can capture the cosmos for around £300. Kathryn Nave kriegerscience.wordpress.com >

How to...

Build your own planetarium

WHAT YOU NEED

- 55m² of corrugated cardboard
- 400 bulldog clips
- String and a ruler
- Black and white water-based paint
- Digital projector
- Half-dome security mirror
- Stellarium (open-source star-projector software)

1

DRAW THE TEMPLATE

Draw a line 113cm long, 2.5cm in from the edge of the cardboard. "Use the compass-and-ruler technique," says Krieger. "But, instead of a compass, use string." Tie a pencil at one end, measure the string out 113cm and pin the other end on one side of your line. "Stretch it to where the top of the triangle should be, then sling the pencil back and forth in an arc. Repeat from the other side of the line, so the two arcs cross at the triangle's vertex."

2

CUT OUT ALL THE PIECES

Cut out the triangle leaving 2.5cm around the sides. Trace around this template to make nine more equilateral triangles. Repeat with another 113cm line, but this time with 100cm of string to make an isosceles triangle – you'll need 30 of them. Cut ten 100 x 113cm rectangles with a 10cm flap along the long side and 2.5cm round the rest. Paint one side of each piece white – the interior facing side – and the other side black to keep the light out.

3

ASSEMBLE THE TRIANGLES

"Assemble the isosceles triangles into six pentagons," says Krieger. "Fill the gaps between them with the equilateral triangles. Build the outer ring first with the bulldog clips, adding the central pentagon last." Have others help with this. "You need something holding all the pieces in place until you add the final keystone – then it supports itself." Now connect the rectangles around the bottom of the dome to make a wall that raises it up.

4

SET UP THE PROJECTOR

Calibrate your projector against a flat wall so it produces a focused image at a distance of about a metre. Place the security mirror on a table at the dome's edge, so the top of the mirror is about the same height as the top of the wall. Line up the projector so the image fits exactly on to the mirror. "To get the image of the sky on the dome you need the free software Stellarium," says Krieger. "Just click on the spheric mirror distortion option."



How to...

Make a drill with a sharpener

If you need to drill a hole, but don't have the proper equipment, what should you do? Comedian Jason Underwood was in just such a situation after packing things for a move. He could have gone to the store and bought a drill, but instead he came up with this ingenious solution. Jeremy Cook

GATHER THE SUPPLIES

The most important item for this build is a hand-cranked pencil sharpener, like the one you probably had in your classroom in school, and a drill bit. Underwood also used a brass fitting to keep the bit straight, and a conduit clamp, wood and wire to keep everything attached to the pencil sharpener.

ASSEMBLE THE DRILL

Remove the cover over the crank and the pencil-grinding cylinders. File the non-drill end of the bit to roughen, then place it where the pencil goes. Put a brass spacer between the bit and sharpener opening. Bend wire around the spacer to keep it in place, then tighten down a conduit clamp where the grinders are.

DRILL, BABY, DRILL

Place the bit tip against where you want your hole, grip the body of the sharpener with one hand and work the crank with the other. Underwood was able to use this crude drill to make the holes he needed, penetrating plywood with ease. "With enough time, I could make a chop saw with a ceiling fan," he says.

ILLUSTRATION: LAURINDO FELICIANO; MARINA MUJIN; MARJORIE NEWNHAM

How to...

See your music



Why settle for your standard music visualiser on your computer when you can create a three-dimensional one simply by filling an old speaker with baking soda? It's simple, cheap – and hypnotic. “This can damage your speakers, so is best done with an old set,” says artist Zach Walker, who creates visual demos for exhibits and parties. You could also easily damage your hearing, so have ear plugs to hand. Bass-heavy music will throw powder a few metres, so be prepared for a mess. You need: a speaker driver, amplifier, soft material, music source (even a phone will do), baking soda and coloured sand. *Zoe Cormier zachwalker.co.uk*

GET YOUR SET

Use a rubber speaker driver that you've removed from an old set, or you can use an intact loudspeaker set if you're not concerned about getting powder all over it. Be sure to use a driver that is convex, with an outward bump in the centre of it, and not concave, so the sand doesn't all gather in the bottom.

SET IT UP

Place the driver on a level surface with soft material under it. This stops the speaker rattling around. Use two objects of the same height, such as old VHS cassettes, to leave a space between the bottom of the speaker and the table, so you have room to connect the speaker wires to an amplifier.

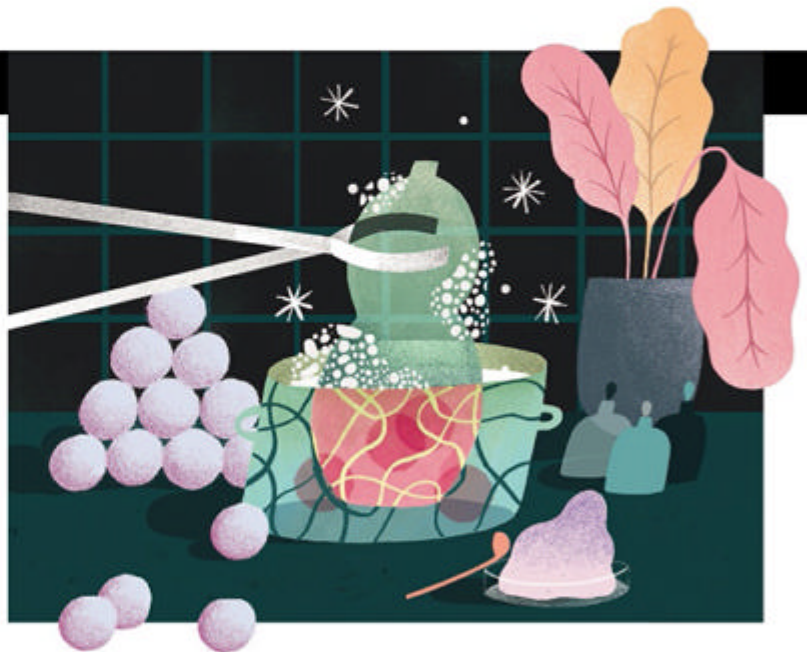
ADD COLOUR

Sprinkle baking soda and coloured sand in the driver. Walker recommends Brian Clegg fluorescent sand, which looks great under UV light. But even the baking soda with one extra colour is enough to create mesmerising, trippy cascades up and down the sides of the speaker driver.

PUMP IT UP

Connect your music source to the amplifier, and play around with different types of music: mid-range notes create gentle cascading patterns, bass notes (with a quality subwoofer) produce big percussive bursts. Walker's favourite tune? “Westwind” by Nina Simone. “It creates amazing patterns,” he says.

How to... Make an edible water bottle



Reportedly, the UK uses 15 million plastic bottles a day – only half are recycled. Yuka Yoneda, DIY enthusiast and senior editor at New York-based sustainable design blog *inhabitat.com*, suggests an edible alternative, based on spherification. Here's how to help save the planet with gelatinous water globules. KN

YOU WILL NEED

- 1 gram of sodium alginate
- 5 grams of food-grade calcium lactate
- A stick blender
- A deep spoon
- A slotted spoon

MAKE YOUR POTION

Use the stick blender to mix one gram of sodium alginate with about 230ml of water. “You have to mix it for quite a while to make sure the sodium alginate is fully dissolved,” says Yoneda. “Then leave it to one side for a few minutes to get rid of any bubbles that may have formed while blending.”

ADD A MAGIC INGREDIENT

In a separate bowl, mix five grams of calcium lactate with 900ml of water. Then spoon some sodium alginate solution into the calcium lactate mix. “It will form a bubble almost instantly,” Yoneda says. Add three to four more scoops of the sodium alginate solution, but don't fill the bowl.

CREATE YOUR BOTTLE

Gently stir the bubbles for around three minutes, then carefully remove using a slotted spoon. Place them in ordinary water to stop the reaction. To make things more interesting, Yoneda suggests using different flavourings or food colouring, but make sure it's non-acidic, as acid will destroy the membrane.



How to... Make a 3D GIF

When one thinks of 3D images, an exotically framed portrait or special glasses come to mind. What might surprise you is a convincing 3D GIF that will display on a computer screen can be made using a normal camera. "We wanted to combine people's love of animated GIFs with the art of stereoscopic photography," explains At-Bristol Science Centre's Ross Exton. [JC youtube.com/user/atbristol](https://www.youtube.com/user/atbristol)

1 2 3

THE EQUIPMENT YOU'LL NEED

The technique of taking two slightly different photos to simulate 3D vision is actually quite old, and was pioneered by 19th-century photographers. As such, all you will need is a camera and a photo-editing package. Ross used Photoshop, but if you don't have that, the free GIMP editing software will do the trick. Any camera can be used, but one that allows for exposure control is ideal to help the photos match up perfectly.

FIND A SUITABLE SUBJECT

Select an object that doesn't move and has clear details in both the background and foreground. Focus on the subject and take the picture. Move the camera a few centimetres to one side or the other and point the camera at the same subject. Snap another picture. If you can, keep the camera on the same settings and at the same height by using a tripod.

COMBINE IMAGES AND ENJOY

Open both pictures on your photo-editing software, lining them up over the main subject. Output the image as a GIF that flickers back and forth between the two. According to At-Bristol's Seamus Foley, each frame should be kept in view for about 1/12th of a second, which is roughly two frames at UK's television default of 25 frames per second. When viewed, the GIF will flicker back and forth, tricking your brain into thinking you're viewing a 3D image.

082 / HOW TO / DESIGN A 3D GIF / INFLATE CDS / CREATE FOG

How to... Blow a CD bubble

You know that collection of CDs you don't play any more? Why not melt them and turn them into a big bubble? According to YouTube broadcaster Jester Jim, the resulting orb will resemble a long piece of cling film. **JC**



WHAT YOU'LL NEED

To blow your CD bubble, all you'll need is a CD and a lighter. It really doesn't matter what's on the CD, as long as you don't want to access the data or music later. You'll also need something with a sharp edge to scratch off the foil surface on the top of the CD; a coin or knife should do the trick.



PREPARE THE CD

Take the CD and scratch an area measuring a few centimetres square off the top until only clear plastic is left. Use the lighter to hold a flame about 1cm to 2cm under the scratched part of the CD for around 20 seconds. Once the CD starts to sag under the flame, the bubble is ready to be blown.



BLOW THE BUBBLE

Immediately hold the heated section of your CD up and blow on it using as much force as you can muster. Hey presto! A surprisingly long bubble should pop out of the other side. Make sure to do this entire process in a well-ventilated area, as burning a CD will release a set of unpleasant fumes.



How to...

Make eerie blanket fog

WHAT YOU'LL NEED

- 6m of 100mm ducting pipe
- 100 litre rubbish bin
- Ducting vent
- Y-tube
- Small fan
- 1,000 Watt fog machine
- Non-glycerine based low-lying fog fluid
- Lots of ice

PREPARE YOUR CONTAINER

Use a circular saw, or a Stanley knife, to cut two holes, just over 100mm in diameter, on either side of the rubbish bin, near the base. "Feed your ducting pipe through one, then coil it all the way around the inside of the trash can, leaving space in the middle, and feed it out the other hole," says Camerano. Next fill up the entire bin with ice.

CREATE YOUR FOG

Attach the ducting vent on one end of the pipe and fix the bottom, single branch of the Y-tube to the other. Place the outlet tube of the fog machine in front of one split branch. "Leave about 10cm between the two to allow air to get to the fog," Camerano says. Place the fan at the other Y-tube opening, fill your machine with fog fluid and turn it on.

Fog machines may be the ultimate special-effects tool, but to achieve a spooky low-lying blanket of mist, you also need to use a fog chiller. "When fog comes out of the machine it's hot so it rises," explains Vincent Camerano, CEO of Chicago-based fog fluids company Master Fog. "You want to cool it down so that it sinks and adheres to the ground." With just a few cheap household parts it's easy to build your own chiller in less than ten minutes. *KN master-fog.com*,

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FEATURES

SCULPTURE: LUDA GALCHENKO. COMPOSITION WAS INSPIRED BY CLASSICAL STILL-LIFE ART AND CONTEMPORARY FOOD STYLING



"It's not a question of courage, it's a question of your personal development." Maria Alyokhina, p86

"Here's to the crazy ones. The misfits. The rebels. The troublemakers. The round pegs in the square holes.

The ones who see things differently. They're not fond of rules... You can quote them, disagree with them, glorify or vilify them. About the only thing you can't do is ignore them. Because they change things. They push the human race forward. And while some may see them as the crazy ones, we see genius. Because the people who are crazy enough to think that they can change the world, are the ones who do." Apple "Think different" commercial, 1997

THINK
DIFFERENT

"It's more fun to be a pirate than join the Navy." That was Steve Jobs at an Apple retreat in 1982, a time when he hung a skull-and-crossbones flag in the Macintosh team's office. For Jobs, the flag was a symbol of the "different" thinking among his own team of rebels and artists compared with the rest of Apple, then a bloated and bureaucratic

corporation. But it's a message that still resonates among the innovators and risk-takers who today are building extraordinary businesses or taking fresh approaches to science and technology. Over the next 22 pages,

we report on the rule breakers we can all be inspired by - from activists to aviators, starting with the Russian music collective Pussy Riot. Because, as the Apple ad said, the crazy ones are the ones who change things.

ALSO

FEATURING PUSSY RIOT [& OTHER PIRATE THINKERS]

MAIN STORY BY

GREG WILLIAMS

PHOTOGRAPHY:

PLATON





ON

a mild November morning a couple of days before Thanksgiving, Maria Alyokhina is sitting in the kitchen at a friend's apartment in the Bedford-Stuyvesant neighbourhood of Brooklyn, New York. Alyokhina, known to her friends as Masha, is sipping coffee and smoking a Russian cigarette, both of which, she says, are helping her to gather her thoughts, as she hasn't had much sleep. The night before, news organisations reported that a grand jury had decided not to charge a white policeman in Ferguson, Missouri, who had shot dead a black teenager, Michael Brown, in August 2014. Spontaneous protests had broken out across the country, prompting President Obama to appeal for calm.

The previous evening Alyokhina had just arrived at the apartment in a four-storey red-brick building when she read on Twitter that a number of demonstrations against the grand jury verdict were taking place in New York City. She headed into Manhattan and, over the next few hours, was one of a few hundred people who blocked the Robert F Kennedy Bridge, which links northeastern Manhattan to Queens and the Bronx. She marvelled at the noise of the crowd, was surprised by the politeness of the New York cops, encountered a journalist from Russia Channel, a state-owned Russian broadcaster, and took a selfie with Perry Chen, the cofounder of Kickstarter, before returning to Bed-Stuy at 4.30am.

As Alyokhina made her way towards the East River that night, the crowds were unaware that among their number was one of the world's foremost political activists – one whose arrest during a protest in Moscow a few weeks later would make headlines across the globe. Along with her associate Nadezhda (Nadya) Andreyevna Tolokonnikova, Alyokhina is part of the feminist collective Pussy Riot, who became a political prisoner following a protest at the Cathedral of Christ the Saviour in Moscow in February 2012.

Standing barefoot in her friend's kitchen in a black dress, Alyokhina holds an iPhone and watches footage of people chanting and marching along a roadway the night before. She has a mischievous, dry sense of humour. When there is talk of a trip to a local Dunkin' Donuts, she softly grimaces. "I'm no snob, but *Dunkin' Donuts?*" the 26-year-old says, before ordering a coffee with caramel.

Tolokonnikova arrives quietly with her husband, the activist Pyotr Verzilov, and takes a seat next to Alyokhina at the open kitchen window to smoke a cigarette. She wears a red-and-white checked shirt and her black hair is dyed

green at the tips. Her face is open and calm with eyes that hover between intensity and wariness. In appearances in the UK the previous week she has been animated, even playful, when onstage, making jokes about the movie *Borat*. Today, she is less buoyant, but registers the humour in what she says – much of it commentary on the grim state of modern Russia – with a small laugh at the end of her sentences.

Alyokhina and Tolokonnikova were released from prison in December 2013 as part of an amnesty that served to demonstrate the capricious nature of the Russian justice system: around the same time Mikhail Khodorkovsky, formerly Russia's wealthiest man, was granted clemency after fraud charges against him were unexpectedly dropped. Greenpeace activists who had been arrested in the Arctic Circle were also freed. In all three cases the releases were perceived as a gesture meant to divert criticism from the regime before the Winter Olympics, held in Sochi in February 2014.

Despite the deprivations of prison, Alyokhina and Tolokonnikova remained energetic iconoclasts. Weeks after being released from their prison camps in Nizhny Novgorod in western Russia and Krasnoyarsk in Siberia respectively, they travelled to the winter Olympiad. On arrival, they and other members of Pussy Riot were attacked by whip-wielding Cossacks – empowered to act as informal security agents for the event – before being detained by local police. Released after a few hours, Pussy Riot then gathered by the interlocking rings that act as the symbol for the games and performed a newly composed song: "Putin Will Teach You to Love the Motherland" – a direct quote from one of the Cossacks earlier that day.

A reasonable course of action for those who face aggressive, bigger, more powerful opponents with limitless resources is to remain on the margins. But Tolokonnikova's extraordinarily articulate and defiant closing statement in court in August 2012 – a speech delivered from inside a cage when she was aged 23 that was shown live on Russian television – established that Pussy Riot was neither contrite nor cowed. During 15 minutes of daring eloquence, she called into question the legitimacy of what was happening: "This mock trial is close to the standards of the Stalinist troikas."

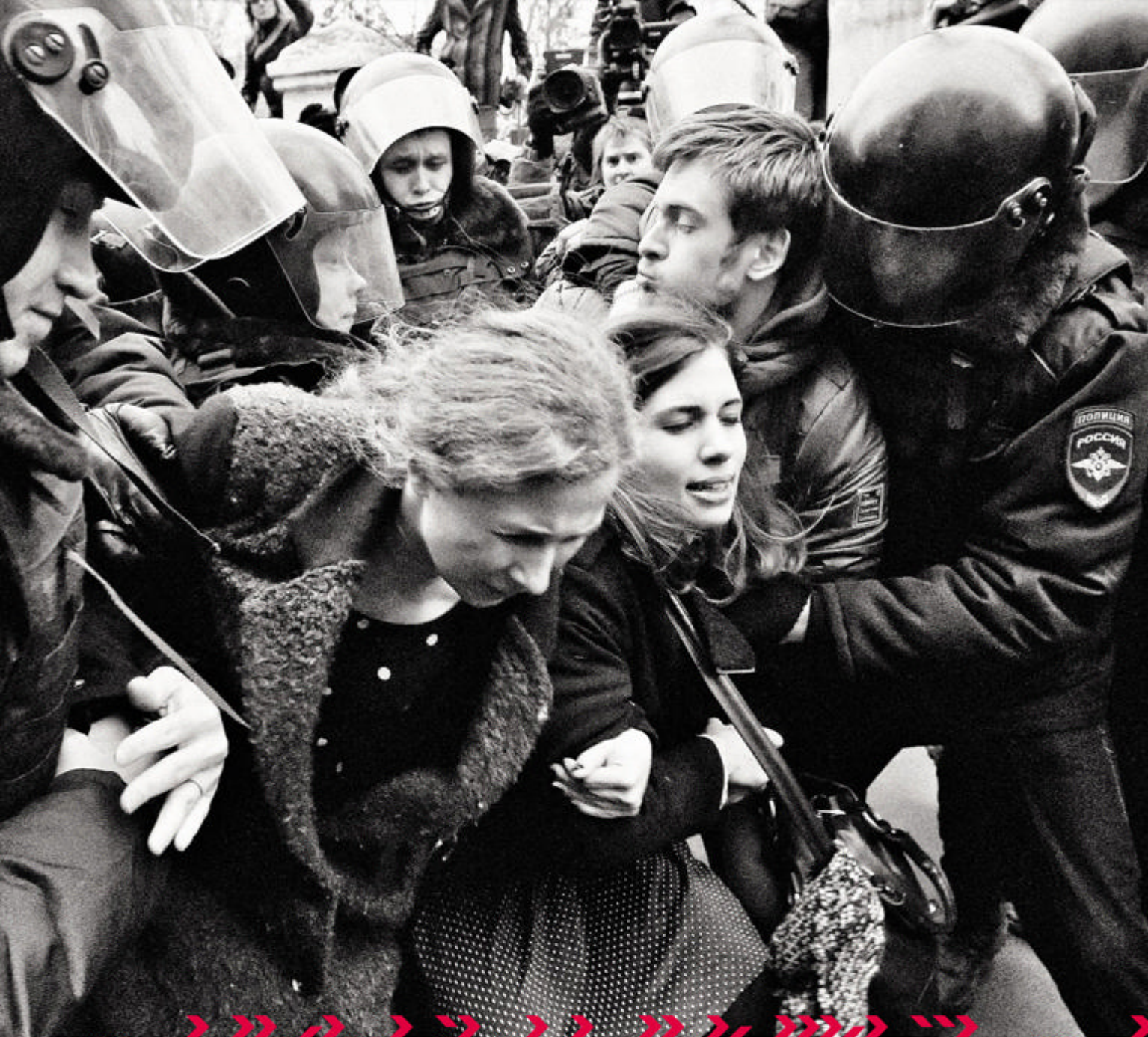
Alyokhina and Tolokonnikova could leave Russia and would almost certainly be granted asylum in the west – Verzilov has Canadian residency after spending

time in North America when growing up. But instead, Pussy Riot is pursuing a new project – a human-rights group and media service that will, once again, pit them against the regime and its president, who in 2012 described them as "having undermined the moral fundamentals" of the country.

"It's not a question of courage, it's a question of your personal development, because everything interesting begins with conflict," Alyokhina says. "It can be personal conflict and it can be public conflict, but the conflict

Riot police apprehend Maria Alyokhina (left), Nadezhda Tolokonnikova and Pyotr Verzilov in Moscow on February 24, 2014





forces you to grow up, pushes you to understand something. If you just have a comfortable life you start to degrade.”

Just as their reputation now offers them – and, by extension, those incarcerated in Russian jails – a voice, so it makes them a target. One morning in March 2014, the women were in the city of Nizhny Novgorod when six young men attacked them, spraying an acidic liquid in their faces and leaving them covered in green stains. They say that Russian security forces routinely harass them. Pussy Riot’s power, as with all dissidents and activists, is that they’re visible – the protest in Christ the Saviour Church lasted less than a minute, yet reached across the globe.



**‘A LOT OF PEOPLE BELIEVE
THESE INCIDENTS ARE
BY OUR OWN HANDS, THAT
WE HIRED COSSACKS
TO CREATE THE PUBLICITY’**

When talking about the beating they suffered in Sochi, Tolokonnikova says wryly: "We don't want to produce a lot of these incidents. A lot of Russian people believe we did this by our own hands, that we hired Cossacks to make publicity..."

"And paid them to beat us!" Alyokhina says incredulously. "We are a special type of masochist."

They are continuing to work on art projects – the New York trip is to discuss a secret assignment to be revealed later in 2015 – but much of their energy is now put into Zona Prava, an NGO focused on prisoners' rights, and a news website, MediaZona, that will report on human rights, prisons and the judicial system in Russia. ("Zona" has a dual meaning in Russian vernacular, also signifying prison camps.)

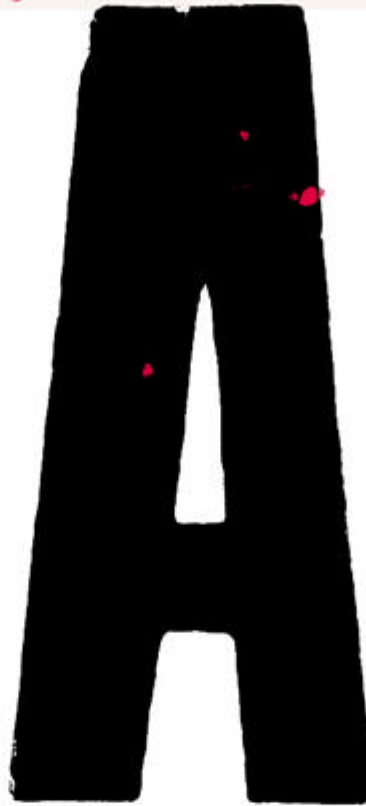
It's a bold and unapologetic move that they see as consistent with other aspects of their work: "When you're doing political art you can sometimes use it in your prison rights or human rights," Tolokonnikova says. "You don't separate it."

The origins of MediaZona, naturally, are in incarceration. While imprisoned, Alyokhina and Tolokonnikova were subject to deprivation and arbitrary punishments. On September 23, 2013, after a year behind bars, Tolokonnikova went on a hunger strike. In an open letter sent from the prison (where, according to Tolokonnikova, the deputy chief of the penal colony described his politics to her as "Stalinist") she described how "fellow prisoners collapse under the strain of slavery-like conditions" and demanded that the administration respect human rights and operate in accordance with the law. After seven days she was moved to the prison hospital.

"There wasn't this much attention on a civil human-rights case in Russia for a long time," Verzilov says. They realised that there was an opportunity to try and change the system in the region where Tolokonnikova was being held and worked with the human-rights group Agora, which includes Irina Khrunova, the lawyer who represents Pussy Riot. Alyokhina also took on the authorities, fighting to have hearings in open court, for access to books and challenging the prison's right to subject her to a gynaecological search when her lawyer visited.

The Russian experience of prison is very different from Europe's: "Everybody knows somebody who is in prison," Alyokhina says. "We have a strong culture of prisons from empire times to the Soviet Union right through to today."

"Estimates are that a third of the population went through the Gulag – it could happen to anyone," says Ben Judah, the author of *Fragile Empire: How Russia Fell In and Out of Love with Vladimir Putin*. "A family that's been through prison in Russia is as normal as a Jewish family in Israel that's been through the Holocaust. It's a cornerstone of the culture."



According to a 2013 survey by the International Centre for Prison studies, Russia has around 681,600 prisoners, 475 for every 100,000 people. Only the US, with 2,239,751 (716 people per 100,000) and China, with 1,640,000 (121 people per 100,000) have more citizens locked up.

Ksenia Zhivago, 24, is in charge of the Zona Prava prison map project, a mission to build an interactive database that provides information on penitentiary institutions across Russia – 758 of which are penal colonies. It's an effort to bring transparency to a system which, in some parts of the country, can be chaotic (after her sentencing, Tolokonnikova went missing for 28 days, eventually emerging in a work camp in Siberia), overcrowded and sometimes corrupt. Teams of Zona Prava volunteers are gathering data points – from official sources, online forums, searches on Yandex and supervisory groups as well as former prisoners, who are answering a 300-question survey. Zona Prava is also working with the Public Supervisory Committee, an official group that has access to prisoners and passes on the questionnaires during visits. "It covers everything from contact details for the administrators, to visiting hours, transport links, medicine, working and living conditions and communication with officials," Zhivago says.

The website also offers practical assistance: there is a hotline that provides access to a psychologist and a

lawyer, but also guidance in navigating bureaucracy. "We also provide help in writing complaints, investigations, cases of death, investigations in penal colonies, phone consultations and the European Court of Human Rights."

The intention, according to Zhivago, is that the database will become close to a real-time picture of the system that will be corroborated at every stage. Zona Prava is working with the Yandex maps API to geolocate each institution and aim to ensure that the platform can be embedded on other websites.

MediaZona is edited by Sergey Smirnov, who when he was appointed had been a casual acquaintance of Tolokonnikova for around five years. During that time he had been reporting for online newspaper Gazeta.ru, covering the military and the political opposition. He rose to prominence after reporting on alleged voter fraud in Russia's 2012 presidential election.

On May 6, 2012 – the day before Putin was to be inaugurated for his third term – hundreds of protestors were arrested after clashes with the police in Bolotnaya Square in central Moscow. Many received lengthy sentences. The protestors, according to one participant who preferred not to be named, were largely educated professionals and the demonstration had been organised via social media.

"That frightened the authorities – it finally made them take the internet seriously," says Ilya Oskolkov Tsentsiper, a media entrepreneur who is also cofounder of the Strelka Institute, a nonprofit educational institution located across the Moscow River from the Cathedral of Christ the Saviour.

Smirnov covered the story in some detail. "The Kremlin was not happy about some of the articles," he says via email. "Gazeta.ru began to experience problems with censorship and some journalists had to quit voluntarily."

Smirnov left to become deputy editor of political news site Russkaya Planeta before joining MediaZona in May 2014. He now finds himself at the nexus of where Russian political life is being played out. "Opposition activity is reduced to constant criminal proceedings in courts," he says. "The [anti-Kremlin] movement's leader Alexei Navalny has received a conditional sentence in a fabricated criminal case against him. Another trial involving him as an accused is running now." [Navalny was given a conditional sentence in December and rearrested hours later.]

Maria Alyokhina (left) and Nadezhda Tolokonnikova, December 2014

'IT'S NOT A QUESTION OF COURAGE, IT'S A QUESTION OF YOUR DEVELOPMENT. EVERYTHING INTERESTING BEGINS WITH CONFLICT'



Gulnaz Sharafutdinova, a political scientist at King's College London's Russia Institute, affirms that the Russian legal system has never really been independent of the Kremlin and that the current system has its roots in the chaos that followed the collapse of the Soviet Union in the 90s. "They created a political pyramid of power and integrated the institutions – legal, law enforcement, political, even economic – to support the power system," she says.

"If you're Putin, you don't want to turn the opposition into martyrs – you want to keep them busy and off the street," Judah says. "Take someone like Navalny: you stick him with a million court cases, so he has to basically fight in the courts for the rest of his life – he has no time to set his agenda."

Sharafutdinova echoes this, describing Alyokhina and Tolokonnikova as having experienced "a very personal touch" of the Russian criminal justice system.

The small team of journalists divides duties between posting around ten news items per day, reporting from the courts and publishing trial updates in a timeline format. In November 2014, there were several of what Smirnov describes as "politically motivated criminal cases" running consecutively in Russia, meaning that the team was continually updating the site with developments. Reports are posted once a day, sometimes more, and investigative and historical stories a couple of times per week. Smirnov says his next goal is to get this up to three a week. Traffic is modest – the relatively narrow focus of the site means that there is a built-in limitation to the audience – at 3,000 to 10,000 visitors a day. The best performing post – reports on the Navalny trial and a female prisoner's story of 16 years inside – gained around 100,000 views.

"MediaZona may be cited as a human rights project, however we work strictly according to the rules of journalism," Smirnov says. "We are journalists and unlike regular human-rights organisations we have to take responsibility for the quality of the information that we deliver. This is why fact-checking is mandatory for us and it is always better if we can get information from official sources."

Judah, who lived in Moscow during the opposition's most audacious years and has travelled extensively within Russia, recalls a time when a new generation of bloggers and media



Above: Tolokonnikova, Alyokhina and Yekaterina Samutsevich sit in a cage during a court hearing in Moscow, August 2012.

Below: Pussy Riot with a group of Zona Prava volunteer workers



Tablet extra!

Download the WIRED app to see video footage of Pussy Riot

entrepreneurs, such as Oskolkov-Tsen-tsipser, were establishing voices that were independent, bold and unfettered by the burden of what had come before.

"From 2007 to 2012 there was a generation of young journalists who didn't remember the Soviet Union and weren't completely fucked in the head by its collapse," he says. "They'd grown up in a Moscow with the living standards of South Korea. They'd also grown up online when there was no censorship and were setting up these cool websites. These were the people who had been to Shoreditch and liked it very much – they wanted to bring that to Moscow."

But the Russia that Alyokhina and Tolokonnikova emerged into when they were released from jail was a very different country: the optimism and boldness of the millennium's first ten years had largely been crushed, along with the political opposition.

In October 2014 Putin approved a law limiting foreign companies from owning more than 20 per cent of Russian media outlets. The legislation was widely seen as a way of curtailing some of the remaining independent voices, such as the business daily *Vedomosti* (which is owned by News

Corp), Pearson and the Finnish company Sanoma. Internally Russian media has been purged: some outlets have been swallowed up by state-run enterprises (the fate of the NTV television station which is now part of Russian energy giant Gazprom), experienced state-sponsored changes in editorial staff (such as news websites Lenta.ru and Gazeta.ru), or been dissolved by presidential decree (the fate of RIA Novosti, the widely respected state news agency). In November 2014, Mikhail Mikhailin, editor of *Kommersant* – a newspaper that once published an issue consisting of blank pages in defiance of a court order – stepped down during a change in leadership that's widely seen as a retrograde step for objective reporting.

A month after the law on foreign ownership was passed, the Boris Yeltsin Presidential Library, based in St Petersburg, announced that it was setting up an alternative to Wikipedia. According to an official press release the online resource will "objectively and accurately present the country and its population," after Wikipedia was deemed lacking in "enough detailed and reliable information about Russian regions and the life of the country".



In August 2014 a new information security law was passed in an attempt to restrict social media: bloggers with more than 3,000 daily readers must now register with a state regulator. Human Rights Watch described it as “another milestone in Russia’s relentless crackdown on free expression”. Verzilov says that, since then, Twitter’s legal department wrote to inform him that it had received a request from the state watchdog Roskomnadzor, asking to know the number of visitors to his feed. From January 1, 2015, all companies that store data from Russian users have to locate their service inside Russia – something that is logistically impossible. Verzilov views it as a ploy – the Russian government knows



‘THERE IS A WAR GOING ON, BUT IT’S NOT A WAR THROUGH WEAPONRY. THE WEAPONRY HERE IS INFORMATION AND VALUES’

that Google, Facebook and Twitter can’t comply, so will try and reach accommodation regarding other forms of data. “The Russian government is preparing the ground for negotiating with foreign internet companies,” he says.

While the large services are robust enough to resist attack, protecting independent news sites such as MediaZona from denial of service (DoS) attacks is crucial to keeping them online. In cases involving state actors the attack is often undertaken using so-called botnets: large numbers of computers that are infected with a virus that can be controlled by a third party. Smirnov says that they are “expecting all possible virus attacks”. Verzilov confirms that MediaZona has been targeted.

“The ability to keep web content online can be the Achilles’ heel of independent media groups – availability is their power, yet they’re easily knocked offline by very cheap DoS attacks,” says CJ Adams, the amiable, goateed, 29-year-old product manager of Project Shield, a Google initiative that works to protect independent news organisations, NGOs, sites detailing election information and human-rights groups from attack. Google allows under-threat websites to route their traffic through its infrastructure, mitigating any attack by filtering out bad traffic. Internet security company CloudFlare runs a similar project named Project Galileo. Incidents of these kinds of attacks have occurred over the past 18 months in Iran, Thailand, Turkey, Ukraine and Russia.

“Tech companies should be listening to those who face these risks – it makes technology better, safer and stronger,” Adams says. As part of the project, his team has created the Digital Attack Map, an online data visualisation that shows, in real-time, the top two per cent of attacks happening across the world according to security company Arbor Networks, which has DoS mitigation boxes on all tier-one and -two ISPs.

“If we can solve the problem for people who face extreme risks, we make everybody safer,” he adds. “Our mission is to make sure that all the world’s information is accessible and useful.”

Alyokhina and Tolokonnikova sit at a table in the apartment. The place is Brooklyn eclectic – there are guitars and a keyboard, artwork throughout the space, an area with a projector and a screen and a zebra skin on the wall. Alyokhina eats a plate of eggs while

Tolokonnikova picks at some carrot cake while curled in a desk chair. Verzilov sits at the table working on a MacBook, occasionally adding to the conversation when asked to clarify a point by Alyokhina and Tolokonnikova. They sometimes rely on him to translate, but today they speak in English which is better than they seem to think it is.

The Pussy Riot project, with its derring-do and pop-punk aesthetic, has provided the group with a platform to address the world about the domestic issues facing the Russian Federation; whether they can initiate change through journalism is another matter.

“News media professionals, reporters and editors need a business model,” Oskolkov-Tsentsiper says, adding that dissenting websites won’t be able to attract advertisers, meaning that they have to be privately funded.

“We make no secret of who we receive money from,” Smirnov says. “Funds are raised by Masha and Nadya [from speaking engagements]. We are funded by various organisations from abroad, but we do not get any money from foreign governments.”

The regime positions Alyokhina and Tolokonnikova as unhealthy outsiders. Sharafutdinova says that Putin has situated himself as the protector of Russian morality, a stance that has become as important as the struggle for mineral resources and oil. “There is a war going on, but it’s not a war through weaponry,” she says. “The weaponry here is information and values.”

At the end of the block where the pair are staying, there is a huge mural named “When Women Pursue Justice” which features a number of prominent female leaders and activists. These include Shirley Chisholm – the first African-American woman elected to US Congress and the first to seek nomination as the Democratic presidential candidate – who described herself as “a catalyst for change”, a nod to those who would come after her.

This kind of historical perspective has resonance for Pussy Riot. Alyokhina talks about their desire to increase the amount of video footage on MediaZona, that the way to engage a potential audience is to show them the “reality” of what is happening.

“After 20 years I hope it will be part of history and people will watch it and they will remember that this way of living, this way of building a country is not right,” she says. “For me, it’s a lot for history – for memory.” ■

Greg Williams is the deputy editor of WIRED. He wrote about Yoox in 09.14

THE NEW RULE BREAKERS



HEARTS SHOULD BEAT

Your heart beats 100,000 times every day, pumping 5.6 litres of blood around your body every 20 seconds. Place two fingers on your wrist: that pulse that you feel is your blood stopping and starting as it moves through your arteries. Your pulse is living proof that you're alive. Or is it?

Billy Cohn and Bud Frazier, two cardiac surgeons at the Texas Heart Institute in Houston who have spent their careers developing devices to replace or assist failing hearts, are out to prove that wrong. The heart doesn't have to pump, they believe – it would be far more durable as a mechanical propeller that pushes blood in a continuous flow around your body. Their invention, an artificial heart, does just that.

The pair transplanted their pulseless artificial heart into 70 bovine calves. The animals all showed a flatline on an EKG, but remained alive and well. In March 2011, the team tested a prototype in a human patient, 55-year-old Texan Craig Lewis, who was suffering with amyloidosis, a rare autoimmune disease. Lewis lived for six weeks with the heart installed, but had to be unplugged when his kidneys and liver failed due to the condition.

Their latest version of the heart – a fist-sized plastic device with two blades on either side of the rotor – is currently being developed with Australian engineer Daniel Timms and, like its predecessor, is being tested in calves. "The device is still pre-clinical, and not for use in human patients, but this may change next year," says Timms. Should human trials be successful, a flatline may one day be a sign of life.

Madhumita Venkataramanan

Surgeon Billy Cohn and the rotor-installed heart he developed with Bud Frazier

SCIENTISTS SHOULDN'T EXPERIMENT ON THEMSELVES

■ **Developing drug treatments** in the lab and ultimately testing them in human trials is a long and expensive progress. David Pritchard takes a different route: testing his theories on himself. The 62-year-old professor of parasite immunology at the University of Nottingham studies

the ways chemicals produced by parasitic worms and insects can affect the human immune system – by exposing himself to these organisms and seeing what happens.

“I was a zoologist first and then an immunologist and now I am an entomologist,” says Pritchard. “I am essentially a drugs-from-bugs person.” He became interested in the link between parasites and humans in the 70s, when he came across anecdotal evidence that people in the tropics who were infected with hookworm (*pictured left*) had fewer allergic reactions, such as asthma and hay fever. It looked as though the worms were suppressing their host’s immune response to avoid being rejected. “The trouble is,” he says, “being infected with too many hookworms causes serious problems, such as anaemia, so we had to find a safe dose that would be enough to suppress allergies but not enough to cause health problems.”

Pritchard was one of ten volunteers who applied a dressing crawling with hookworm larvae to his arm to see how many worms the body could tolerate.

“I found out the hard way the upper limit is about 25 worms,” he says. “More and you get cramps and diarrhoea.”

Pritchard and his team identified two blood-feeding enzymes from the hookworm. These are now being used in research at George Washington University into a vaccine against hookworm. Meanwhile, in Nottingham, he is working on ways of using the worms to alleviate the symptoms of multiple sclerosis.

And he is still exposing himself to bugs – this time, maggots. “I’m interested in a wound-cleaning maggot called *Lucilia sericata* and the immune response it causes,” he says. **David Baker** nottingham.ac.uk

can be an asset. “It’s a joint effort,” says Sonne, now based in Wilmington, Delaware. “We’re not just trying to prepare people with autism to fit into the labour market, we are using our experience to teach the employers.”

Specialisterne is now active in 13 countries, including the UK, with employee figures in the triple digits. Its biggest partner, German software giant SAP, has promised one per cent of its workforce, or 650 people, will be people with autism by 2020. Currently, 42 employees have been introduced; Jose Velasco, head of SAP’s Autism At Work initiative in the US, says the new employees are integrating well in both a professional and personal capacity. “They’re just another member of the team,” he says. Specialisterne is now set to expand its programme: 30 companies in the US alone have expressed interest in the project and Sonne is now working with global IT specialists CAI, HP and several other high-profile clients. His ultimate aim: to create a million jobs for individuals with autism – and in the process change perceptions of the condition from a disability to a skill set. **Sophia Epstein** uk.specialisterne.com

RULE BREAKER #4 Specialisterne

DISABLED PEOPLE CAN'T WORK

P **people with autism often find it difficult to find employment, but what if their “special” qualities could be channelled into economic value?** Thorkil Sonne has created an international business, Specialisterne (The Specialists), to connect hundreds of people with autism to companies in which they can excel. It began when Sonne’s son Lars was diagnosed with autism at the age of three, and his natural aptitude for attention to detail, recollection and other skills considered vital in software engineering became obvious to Sonne, a Danish former IT director. “Autism is a disability,” he says. “But in the right setting these people can be very, very abled.”

Sonne, 54, does not ask for charity, unlike many working in the disabilities sector. Instead, he shows big names in the STEM sector how those with autism



Y

ouTube is home to many beauty vloggers, but Michelle Phan is undoubtedly its queen. More than seven million subscribers tune in to the 27-year-old's video makeup tutorials, which have been viewed over one billion times. And, in the process, Phan has turned her face – and the things she puts on it – into a multi-million-dollar brand.

"I am self-taught in every way," says Phan, referring to both her knack with a lipstick and eyeliner and her entrepreneurial skills. She now has her own L'Oréal beauty line, em by Michelle Phan, has founded a makeup subscription startup, ipsy – she claimed more than 700,000 subscribers last October – and most recently collaborated with London-based music licensing company Cutting Edge Group to launch her own record label.

As for her YouTube channel, it's no longer a one-woman show: Phan has expanded her reach to a multi-channel lifestyle network being developed with digital production agency Endemol Beyond. Her intention: to create the next generation of talent agency for YouTubers. "Four years ago my goal was to build a network and launch a makeup line," she says. "Now that I've achieved both, I really want to help others who are talented to build their own brands." **Sophia Epstein**
michellephan.com

~~YOU CAN'T BUILD A BUSINESS ON VIDEO SELFIES~~

RULE BREAKER #5 **Michelle Phan**



MESSAGING APPS SHOULD MAKE MONEY



our days after Facebook announced its \$19 billion acquisition of WhatsApp on February 19 last year, an unadvertised six-month-old free messaging app called *Telegram* was downloaded 4.95 million times. *WhatsApp*, to be fair, had experienced a four-hour outage that weekend, but even after service resumed, its little-known competitor continued to grow like wildfire – reportedly becoming the top free App Store download in 46 countries from Argentina to Austria, a *de facto* alternative for anyone concerned about

Facebook's new ownership of the world's most popular messaging app. By March 24, *Telegram* was reporting 35 million monthly users and 15 million daily actives; and on December 8, it said it was delivering more than a billion daily messages for what were now 50 million active users, still growing at around a million a week.

At first glance, the newcomer is not radically different from *WhatsApp* – which, at Facebook's acquisition, seemed unassailable in its viral growth, with 450 million active monthly users and rising at around a million a day. *Telegram*, too, offers individual and group messaging, and lets you and your contacts share photos, videos and other files; and like *WhatsApp*, has neither advertising nor clutter to detract from the simple user experience. But *Telegram*'s advocates were quick to promote some fundamental differences: unlike a Facebook-owned product, *Telegram* was, as its home page declares, about “taking back our right to privacy”, built around hardcore encryption. Second, unlike subscription-funded *WhatsApp*, it was robustly anticommercial, with a promise of “no ads, no subscription fees, forever”. And third, rather than having a profit-seeking corporate parent, it was run and funded by an outspoken and now exiled Russian opponent of Vladimir Putin's regime, Pavel Durov, who had built and lost control of the country's biggest social network, VKontakte (VK).

Bloomberg News once called Durov “the Zuckerberg of Russia”; in April 2014, after posting on his VKontakte wall that he had been “fired” and the

network placed under “the complete control” of Putin allies Igor Sechin and Alisher Usmanov, he promptly left his homeland to begin a continuing period of multi-country exile. His dismissal occurred five days after he publicly refused an order to give the security services access to information about Ukrainian protestors using the network, and to block the page of opposition politician Alexei Navalny.

Durov, 30, has just reached London from San Francisco, before heading for Helsinki. It has been a restless few months: WIRED last met him in Paris in June, where he and his brother Nikolai, 34, had recently arrived from central Europe. At the time, he was uncertain of his next steps beyond a certainty that returning to Russia would be a high-risk option. As he had posted on Facebook itself a few weeks earlier, he and his team of 12 engineers (led by Nikolai, a multi-time gold-medal winner at the International Mathematical Olympiad) were in search of “a country that will allow us to develop our projects with privacy and freedom of speech in mind. To give you an idea of our preferences,” he wrote, “we dislike bureaucracy, police states, big governments, wars, socialism and excessive regulation. We like freedoms, strong judicial systems, small governments, free markets, neutrality and civil rights.”

Durov, dressed in black, remains homeless – his base, he says, is “everywhere – I feel comfortable in San Francisco,

‘THE DIFFERENCE BETWEEN THE KREMLIN, THE WHITE HOUSE AND WESTMINSTER LIES MOSTLY IN THEIR PR’

Pavel Durov photographed by WIRED in central London, December 2014

London, Berlin. I don't want to be dependent on any place or government." He can't see himself moving back to Russia. "The rules of the game are unclear in Russia," he says quietly as we walk on Hampstead Heath – and in his case, that means uncertainty about his personal safety. "I'm not afraid of anything," he says. "I'm not afraid to die, if I have to. There was this Greek philosopher who said that death has nothing to do with you, because either you exist or death exists. In my past, it looked like I could get into trouble in Russia – but I was not afraid then, and I'm not afraid now. Fear paralyses you and doesn't let you go forward."

Still, didn't he leave last April because he felt threatened? "You could call it a business decision," he says with a smile. "This was the point at which I was fired from my own company. Telegram was the only project I was involved with, and Telegram is a global project. It made perfect sense to operate it outside Russia." Still, he knew he had made powerful enemies. "Some people advised me to leave," he says. "I could have stayed, made some compromises on the way, maybe regained control of the company. But that was not something I wanted to do. Compromises lead you nowhere. You can't be happy doing something you don't believe in."

He was simply a tech guy who had unwittingly waded into politics. "Obviously I do have political views – I'm a believer in the free-market economy; I also believe that without competition and respect for human rights there will be no progress because nobody will feel safe and free. But what I've been trying to do is create value for our users and be honest with them. I chose to try to do the right thing. It doesn't make sense to keep going forward without strong principles. I don't think money is the thing that can make you go forward – it's ideas that you believe in."

With Telegram, Durov has a renewed sense of mission. "We're trying to create a new type of IT company, one that never focuses on maximising profits, but instead provides value to society," he says. "We are raising the bar of human communication." And that means turning down the constant offers of VC funding that he receives, because "it is imperative for this goal that we remain independent". Instead, he is funding the project personally: he announced last January that he had sold his 12 per cent in VKontakte, at a time when the network was reportedly valued at \$3bn (£1.9bn) to \$4bn.

There is, he says, a wider purpose behind Telegram: "Secure messaging should be free for everyone. Displaying ads alongside your private communication seems out of place, even immoral." Besides, other messaging apps on the market are not, he says, up to par. "We're aiming to set a higher standard for messaging technologies, to raise the bar of communication in terms of speed, security and versatility."

'MY ADVICE? DON'T BE BOUND BY THE OPINIONS OF OTHERS. THE MAJORITY IS ALMOST CERTAINLY WRONG'

He has long sparred with WhatsApp cofounder Jan Koum, originally from Ukraine. When Telegram launched in August 2013, Koum was quoted in a Russian magazine as accusing him of plagiarism: "Pavel Durov only knows how to copy great products like Facebook and *WhatsApp*," Koum was quoted as saying. Last November, Durov responded in a post on Medium titled "How To Predict *WhatsApp* Features": "A great thing about building Telegram is that you can force bigger apps to improve their products, and also predict their actions," he wrote, before listing features he suggested the incumbent had copied from his more innovative app. "They still didn't catch up with us."

Now he is keen to specify the differences – not least the open-source security protocol, MTProto, created by Nikolai. "Telegram is unique in three regards: security, speed and cross-device sync," he says in an email. "It is the only mass-market messenger that is open-source. You and I don't have to trust Telegram that it is secure – the apps are verifiable." The company offers a \$300,000 bounty, so far unpaid, to anyone who can hack its encryption.

Speed is a big focus. "According to benchmarks, Telegram is the fastest messenger in terms of delivery speed," Durov says. "And like other apps, it can seamlessly sync your message history across several devices, including laptops and tablets. Combined with group chats and the ability to share files of any type, this brings many small teams and businesses to Telegram."

What of user privacy? "Since the day we launched we have disclosed exactly zero bytes of private data to governments and third-parties," he says. "How is this possible? Firstly, end-to-end encryption, self-destructing messages and self-destructing user accounts allow us to know as little sensitive info about our users as possible. Secondly, Telegram is spread legally and physically across several jurisdictions, which allows it to avoid being an easy target for data requests and regulators. Thirdly, we don't do deals with governments that threaten to block us. We are not here for market share and revenues anyway, so we can ignore these threats." Will he continue to bankroll the business – or does he see revenue opportunities? "We will become financially sustainable at some point," he says. "It will most likely involve third-party paid apps built on the Telegram platform."

At VKontakte, Durov earned a reputation as an unconventional CEO. In December 2011, when the Kremlin

RULE BREAKER #6 Pavel Durov

demanding that he block the pages of opposition politicians, he responded by tweeting a photo of a dog wearing a hoodie. The following May, he prompted fury by tweeting on Russia's Victory Day that "67 years ago, Stalin defended Hitler's right to punish the population of the Soviet Union". A short time later, he and colleagues threw 5,000-rouble notes out of their Moscow office window, prompting fights in the street.

Was his reputation for controversy justified? "Unlike Telegram, VK had shareholders and advertisers, and was dependent on bureaucrats from a specific jurisdiction," he reflects. "Every time their interests clashed with the interests of our users, I stood by the users. This may have created controversies, but I am proud we have lasted for seven years that way."

And his lack of respect for the Kremlin? "I regard most big governments as outdated centralised structures, with a lot of legacy from medieval times. The difference between the Kremlin, the White House and the Palace of Westminster lies mostly in their PR. In Russia I followed my common sense and the country's constitution. That's why I refused to block opposition communities and that's why I declined to hand over Ukrainian users' private data during the protests."

Didn't that cost him control of the company? "Yes, but power and money mean nothing if you betray what you stand for. If you stick to your principles, you can rebuild what you once had."

"I did make mistakes while building VK – like taking outside investment, or depending on a single jurisdiction. I will not make these mistakes again."

And his August 2013 offer of a job to Edward Snowden – was that genuine?

"I will always be grateful to Edward," he says. "In a way, he is the reason why Telegram exists. He showed that the surveillance problems I was experiencing were not specific to one country."

For now, Durov seems contented living an itinerant life, booking rooms on Airbnb for each destination. But what would he advise those wanting to follow an independent path in Russia today?

"My advice would work for any country – don't be bound by the opinions of others," he replies. "The majority is almost certainly wrong. If you can, try contributing to the global market, not the local one. If you face excessive regulation or over-taxation, move to another country." **David Rowan**





Activists are no longer content with reclaiming the streets – they're taking to the skies via small, remotely operated aircraft. "There are many consumer drones being released, and they are getting better, cheaper and easier to operate," says Pinit Asavanuchit, who built a drone and used it to film the anti-government uprising in Bangkok in 2013-2014. "Thai police and media report these events with bias – especially the number of protestors and how they're protesting," he says. "I wanted to see it from a bird's-eye view to better understand what's really happening."

By filming from several hundred metres above, Asavanuchit was able to use his drone not only to gather an overview of the scale of the protest, but also to zoom in on violent clashes between police and demonstrators without risking his own safety.

Videographer Nero Chan had a similar idea during the pro-democracy protests in October and November 2014 in Hong Kong. Manoeuvring a DJI Phantom 2 quadcopter between the city's skyscrapers, he captured images of thousands of people covering the streets below. "I was surprised that my video received over a million views," he says. "I

think it was popular because drone footage is a very new thing. Not many news outlets are using it yet." In future, he suggests, activists could use drones for more than just documentation: for example, flying banners or transporting supplies.

As affordable and high-quality remotely operated aircraft increasingly make their way into the hands of everyday citizens, so authorities around the world are scrambling to create legislation regarding their use. Asavanuchit, who also employs his drone for building-site surveys and plans to adapt it to assist sea-rescue missions,

hopes the potential of the flying machines to save lives and help businesses won't be crushed by regulation. "If we let people drive cars, then we should allow them to use drones." **Kathryn Nave**



Top: Pinit Asavanuchit's aerial footage of the 2013-14 uprising in Bangkok. **Above:** Nero Chan's quadcopter framed November 2014's Hong Kong protests

GOVERNMENTS CONTROL THE SKIES

Unbound's Dan Kieran has written nine books, including *I Fought The Law* and *Crap Towns*

RULE BREAKER #8 **Unbound**



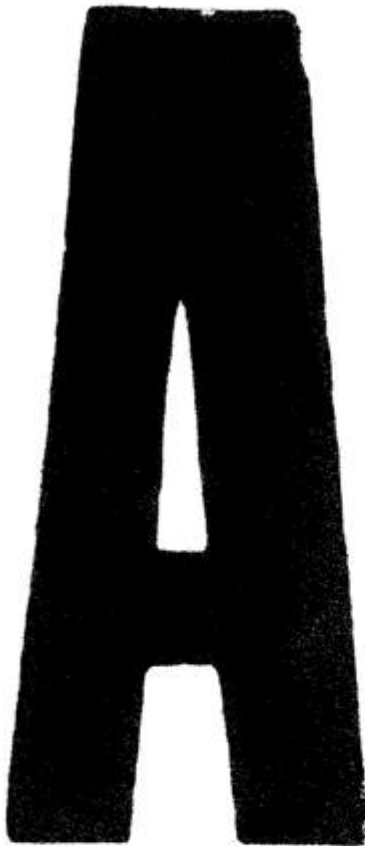
Getting a book published used to be simple: you'd write a proposal and shop it around publishers who – if you were lucky – would pay you an advance and, eventually, a small share of any profits. That was the case for Dan Kieran: before he cofounded crowd-funding startup Unbound, Kieran was a *Sunday Times* bestselling author. But the financial crisis, coupled with the ebook revolution, changed everything. "After the crash in 2008 and the rapacious nature of Amazon became clear, it became impossible to get any kind of advance," says Kieran, 39. Authors quickly found their incomes in tatters. (The median income for professional authors was just £11,000, according to a 2014 Authors' Licensing and Collecting Society survey.) Unbound changes that, by turning readers into patrons.

Kieran founded the company in 2011 with fellow authors John Mitchinson and Justin Pollard. The site uses the Kickstarter model: authors submit a proposal to readers, who can pledge anything from £1 upwards for the book and extras such as merchandise or meetings with the author. "The average pledge is £35, seven times the average prices paid for a book in a shop," Kieran says.

Unbound offers authors a 50/50 profit share. One recent title, *Bitcoin* by Dominic Frisby, received 592 backers. Had Frisby used Amazon, Unbound estimates that at typical prices it would have earned £2,500. "Amazon might take half that money, and the publisher will take the other half," says Kieran. "The author is looking at getting around £125." Published through Unbound, however, the book generated £17,000.

Unbound has now funded 50 titles, and, in 2014, the company had one longlisted for the Man Booker Prize: Paul Kingsnorth's *The Wake*, a historical novel set in the 11th century and written in a fictionalised version of Middle English. "Paul's book was turned down by every publisher in London," says Kieran. "We had 400 people back it, and it got Man Booker longlisted. That suggests the crowd has critical as well as commercial tastes."

Unbound still faces hurdles: in December, Faber & Faber announced it had acquired the rights to Kingsnorth's sequel. But he isn't bitter. "Publishing is too important to be in the hands of Jeff Bezos, Apple, me or anyone else. That power should reside in the hands of authors and readers." **Oliver Franklin** unbound.co.uk



Andras Forgacs grows meat and leather in a factory, not a factory farm. Modern Meadow, the Brooklyn-based startup he cofounded alongside his father Gabor, creates animal protein using biofabrication: cell and tissue cultures grown from cows' muscle cells. Motivated by the environmental cost of meat production and the growing demand for it in developing

countries, Forgacs, 38, developed a new way to make meat. "We are not aiming to make burgers or steaks," says Forgacs. "Our aim is to create new foods that are delicious, healthy and good for the planet."

Currently, livestock uses a third of the world's ice-free land and eight per cent of drinkable water, and produces 14.5 per cent of greenhouse-gas emissions. Modern Meadow aims to offer an alternative. "If trying to make better products in a way that does not wreck the planet is considered breaking rules, then we are proud to be doing so," says Forgacs.

Others have also been working to find an alternative method of meat production. Dr Mark Post, for example, made a test-tube burger as a part of Maastricht University's Cultured Beef programme. What sets Modern Meadow apart is its additional focus on leather production. "Growing skin for medical applications is not new," says Forgacs, who previously cofounded Organovo, a company focused on growing human tissue for medical research. "But the application of this type of technology to consumer materials and leather is still uncommon." And Forgacs believes convincing the public to wear biofabricated materials will be much simpler than convincing anyone to eat them.

The tissue can be tweaked for a specific purpose. This means the lab-created products can be grown into a particular shape or thickness, ending up with less waste. "We are particularly keen to tune their design and performance properties to be ideally suited for each application," says Forgacs.

MEAT COMES FROM ANIMALS

To create the leather, cells are removed from the animal through a biopsy, then isolated and multiplied. These cells, with a bit of coaxing, create collagen; this is spread out into thin sheets, which are layered on top of one another and allowed to mature. The resulting product is then tanned, like traditional leather, but in a less chemically intense process. "We are not looking to create an ersatz leather, but rather truly biological leather materials that are unapologetically original," says Forgacs.

Modern Meadow recently raised \$11 million (£7m) in series A funding - \$10 million from Horizons Ventures - and has grown the size of its team from eight to 15. "Our next step," says Forgacs, "is having a biofabricated leather material that we can unveil initially in high-end and limited-edition pilot applications." Something they expect to be doing by 2016. Finally, meat and leather even Morrissey can't complain about. **Sophia Epstein** modernmeadow.com



CARS DON'T FLY

Futurists have long dreamed of flying cars – and Slovakian startup AeroMobil has finally built one fit for purpose. The 460kg machine only has room for two people, but it can fly for 700km at speeds up to 200kph.

Made from a steel frame-work with carbon coating, the AeroMobil 3.0 is powered by two 100hp Rotax 912 engines, one for the plane and one for the car, and has been invited to show at the Paris Air Show this June.

"Many have tried to build flying cars and pretty much everyone has failed," says AeroMobil's Bratislava-based chief strategy officer Martin Bruncko, 38. "It's quite an engineering feat because cars and planes don't integrate." For example: stability in a car is achieved through weight and width, whereas planes need to be narrow and light. AeroMobil has found a way to balance both, inventing small wings for changing the direction of flight and a steering system that can be used for both driving and flying.

The 3.0 is the brainchild of AeroMobil cofounder Stefan Klein, who grew up in Bratislava (then Czechoslovakia) during the Cold War; he dreamt up the concept as an inconspicuous way to escape to Austria in the west, just over the Danube.

The AeroMobil 3.0 only needs 250 metres for take-off and 100 metres for landing, and doesn't even require Tarmac. It is also fitted with G2S avionics, which supply autopilot for safe flying. "AeroMobil is a fully functional car and a fully functional plane," says Bruncko. The startup now has 12 staff working on a retail version of the vehicle, but will not release its intended price. We're looking forward to testing out any self-driving/self-flying versions.

Sophia Epstein aeromobil.com



MEDICAL BREAKTHROUGHS RELY ON BIG PHARMA

When it comes to science fair projects, most school kids just stick to papier mâché volcanoes. At 17, Florida student Brittany Wenger created an artificial brain for detecting cancer. Wenger's program, which enables accurate recognition of complex patterns by modelling the parallel processing capabilities of biological neural networks, was the winning entry for the 2012 Google Science Fair.



The AeroMobil 3.0 fits into a normal-sized parking space and uses regular petrol

Thousands of entrants from around the world take part in the annual competition for a top prize that includes a \$50,000 (£32,000) scholarship and a much-coveted internship at Cern, Google or LEGO.

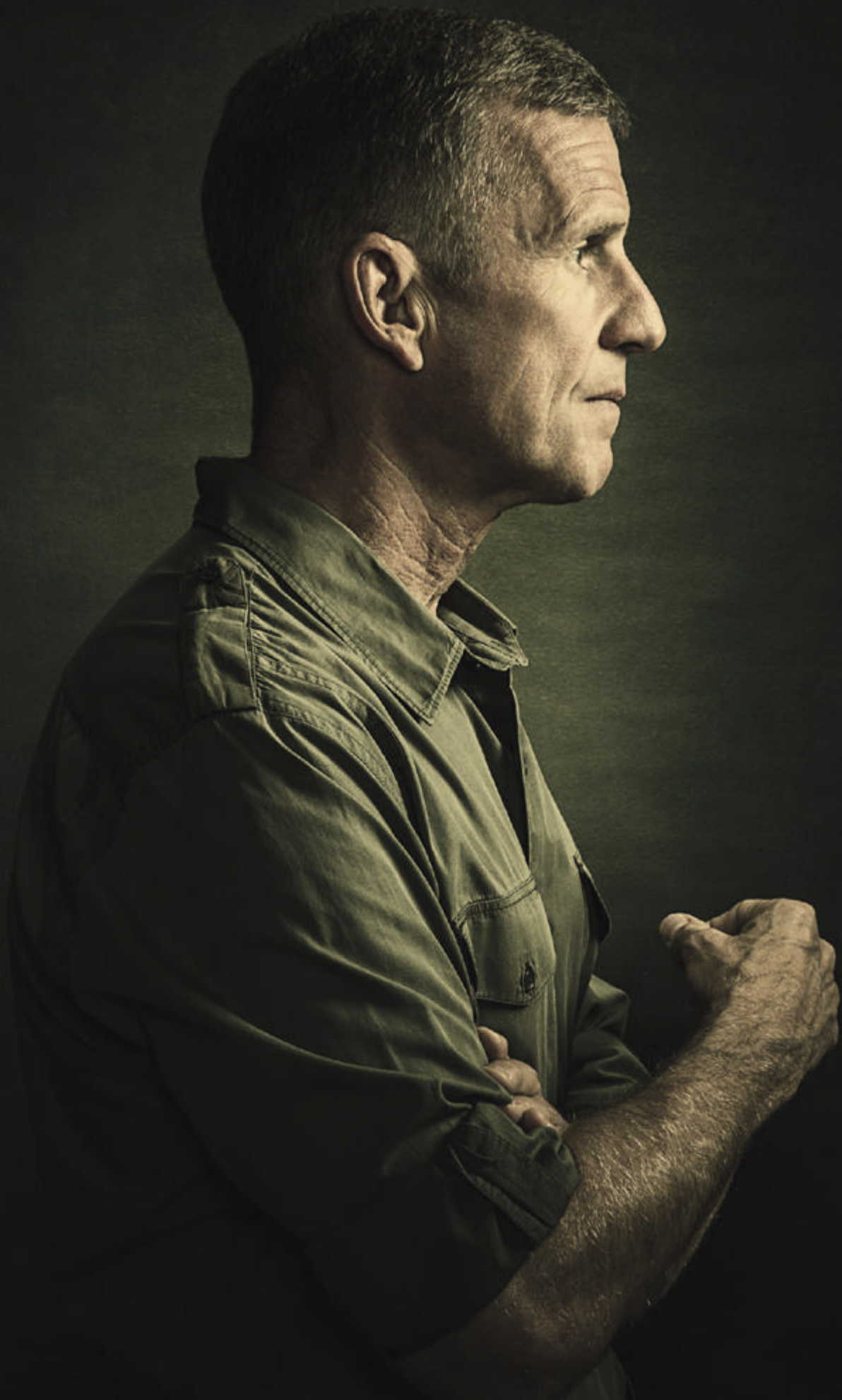
When Wenger applied this pattern-recognition power to a public database of non-invasive samples of breast mass tissue, her network was able to detect malignancy with a

remarkable 99.11 per cent sensitivity across 7.6 million trials – a better rate than the best commercially available method for cancer diagnosis.

Wenger is now studying computer science and biology at Duke University in North Carolina with the aim of becoming a paediatric oncologist. She continues to test her programme at one of Duke's cancer research labs and has opened it up online to the

RULE BREAKER #11 *Brittany Wenger*

public, with several hospitals trialling the system. As neural networks continually adjust and improve their accuracy in response to receiving new information, this means that Wenger's brain will continue its learning right alongside her. **Kathryn Nave** cloud4cancer.appspot.com



BY
KEVIN GRAY

PHOTOGRAPHY:
CHRIS CRISMAN



GENERAL STANLEY
MCCHRYSTAL LED A
NEW KIND OF
WARFARE TO TAKE
ON AL-QAEDA

HE'S NOW ADAPTED HIS
STRATEGY FOR THE
CORPORATE BATTLEFIELD -
AND DEMAND IS BOOMING

IT'S 05:45 HOURS ON
A DARK, COLD OCTOBER
MORNING. WASHINGTON,
DC IS RINGED BY AN
ORANGE, PRE-DAWN LIGHT.
THE CITY'S BUREAUCRATS
ARE ASLEEP. A TALL
MAN WITH GREY EYES,

GENERAL STANLEY MCCHRYSTAL



IS SHEATHED IN
BLACK RUNNING GEAR
AND TRAINERS.

His team – former Navy SEALs and Green Berets who have killed enemy fighters in Iraq and Afghanistan – are huddled in an open-air rotunda. A five-metre-tall bronze statue, covered in pigeon guano, looms over them.

“Our journey starts here, with Thomas Jefferson,” says one of his men, addressing 45 business executives – here from global technology giants such as Seagate, Intuit and Microsoft – shivering and yawning in the chill of the early morning.

The special-ops atmosphere is a little red meat for the executives, who have journeyed here from across the US to immerse themselves in the retired four-star general's CrossLead training programme, now in its fourth year. McChrystal and his team of former elite military operatives teach executives how to use the same organisational design, social psychology, network-

theory analysis and communications technology that helped him transform the Joint Special Operations Command (JSOC) and take on Al-Qaeda in Iraq and Afghanistan.

The pre-dawn, seven-kilometre run (or jog or walk, depending on ability or enthusiasm) around the national monuments is one part of a two-day seminar. It's meant to foster good habits and better health, build fellowship and, most importantly, impart lasting lessons on leadership. After hearing how Jefferson doubled the size of US territory, McChrystal leads a jogging team of 17 people (his jog is your run) to the Washington Monument. Here, with the Sun rising at his back, he could be rallying troops on a battlefield.

“The essential man, they called him,” McChrystal says to the hushed team encircling him. “He had opportunities to become a dictator. That's what some people wanted. But he said, ‘I've grown half blind in service of my country. My title should be Mr President.’ Setting a tone. His greatness was not in being president, but setting a tone for the nation.”

To hear McChrystal, 60, talk about leadership is like hearing Steve Jobs talk about innovation or Henry Ford talk about productivity. The former general is a warrior and visionary who turned a bulky bureaucracy into a fast-moving force that helped wipe out Al-Qaeda in Iraq and is credited with turning the tide of that war as well as the one in Afghanistan.

It wasn't easy. During his five years commanding JSOC, from 2003 to 2008, his team of spies and black-ops fighters faced the enormous challenge of moving quickly enough against an enemy that used off-the-shelf technology, worked in cells with no hierarchy, and were boosted by a seemingly endless supply of fighters. Waging war against an amorphous enemy in 26 countries (with only two publicly declared) meant teaching a sprawling organisation – Navy SEALs, Army Deltas, the SAS from the UK and Australia, and the CIA – to think and act with a single hive mind.



McChrystal's approach relied on a wave of new technologies – GPS, Predator drones, night-vision goggles, smartphones, fingerprint scanners and video conferencing uplinks straight from raid targets. He dismantled the hierarchy that dominated the military to become, in his words, “like the enemy, decentralised, fast”. The result was a force so secretive, lethal and agile, it decisively destroyed Al-Qaeda in Iraq and dealt a significant blow to insurgents in Afghanistan.

Since retiring in June 2010, McChrystal has taken the battle to large corporations. They see a parallel in the threats that coalition forces faced in Iraq to the ones they face every day from lean, scrappy competitors. Threats to today's established

companies are asymmetrical too, and require new thinking. Speed to market, new product lifecycles and super-tight margins mean businesses need to be fast, nimble and restructured to enable high-performing teams in different time zones.

"Legacy technology companies, the big guys, are all worried about the same thing, the small startup coming out of the dorm room, borne on the latest technology, taking huge swipes at us," says Brad Smith, CEO of software giant Intuit, a CrossLead client. "How do you take a company at scale and move it with the speed of a startup?"

It's not just the threats that are analogous. The communications technology and shared thinking that McChrystal employed militarily makes sense to the Silicon Valley's CEOs. "The tactics they used to accelerate productivity, to improve the communications layer, can be used very effectively in the business world," says Todd Bradley, former head of Hewlett-Packard's printers and PC division, which accounts for \$16 billion (£10bn) of HP's revenue. Bradley brought McChrystal's team in to streamline his sales force. "The pace of our industry makes it especially relevant to the tech world, to the pace of change in products, sales force and customers."

The tech industry has become the biggest convert to CrossLead's approach, accounting for as much as 85 per cent of its clients, says David Silverman, a 38-year-old former Navy SEAL who served under McChrystal. The company has doubled in size each year. It now employs 80 people – drawn from the military, psychology, social science, motivation specialists, HR, consulting – providing a hybrid of skills, viewpoints and expertise. On-site engagements last from three months to 18 months, during which time McChrystal's team offers a combination of leadership philosophy, practical advice, executive coaching, systems analysis that mirrors combat targeting analysis and hands-on assessment on how to use technology for internal communication to provide what CrossLead calls "shared consciousness", or thinking as one.

McChrystal's role is to attract clients via talks at events such as TED, as well as offering expertise on the ideals of leadership. That's why today's run includes stops (and mini lectures) at memorials to the second world war (bringing together bickering nations to defeat a common enemy); Martin Luther King Jr (change through inspiration and leadership); Franklin D Roosevelt (facing fear itself and using technology, in his case fireside radio chats, to rally millions of people).

McChrystal seems particularly fond of George Washington, who, like him, was a lifelong soldier. "When he died, the country asked, 'How do we honour him?'" says McChrystal, with the echo of a man half speaking of his own legacy. "We named a city after him. We built this monument. It was supposed to be elaborate at first, but that's not who he was." With that, he sprints off to a crossing with a red light. "Embrace the risk," he jokes, before leading his fellow runners across.



McChrystal's team works from a first-floor former call centre two blocks from the main drag in Old Town – the historic centre of suburban Alexandria, Virginia, which is about 11km from DC. The space is lined with glass-walled conference rooms with whiteboards and inspirational slogans on the walls. The main attraction is at the end of the floor – the Situational Awareness Room (Sar), a mock-up of the general's own Sar at JSOC. Tables are arranged in concentric hexagons, fanning out from a wall of clocks showing local time in various countries, and a dozen flatscreens, similar to the set-up from which the general once called up spooks and fighters in combat zones.

"It's kind of like in a Batman movie," says the general, dressed an hour or so after the run in baggy pleated khakis, a blue shirt and a pair of cross trainers. "But you have to imagine it with the lights down low and a lot of yelling."

McChrystal might be the face of the outfit, but Silverman is the one who started it all with a business plan in the general's living room, in 2011, just weeks after McChrystal retired. Born in California, the son of a Naval aviator, Silverman is CEO of CrossLead and is equal parts military brat, surfer dude and highly focused Valley entrepreneur.

"I said to him, 'If you want to make a boatload of money, you want to go into defence contracting, or run for office. I'm pretty sure those options are on the table,'" says Silverman, who displays the energy and physique of a wrestler, has the blond eyebrows of a beach athlete, and wears stars-and-stripes cufflinks. "But I knew he had this internal passion for changing organisa-

tions and was amazed when he said, 'Let's do it.'" They began the McChrystal Group, the umbrella company for CrossLead as well as the general's speaking tours, with Silverman as cofounder and CEO.

The Sar is packed and bustling as the executives settle down with coffee and pastries. Today's seminar is a refresher for top clients as

COMPANIES AT WAR

1/SCOTTS

US-based gardening company Scotts came under attack in the six weeks of the year that account for 75 per cent of its revenue.

It took 49 days to react to a competitor's negative ad campaign. The company's president, Barry Sanders, brought in CrossLead to build a version of McChrystal's Iraq control centre to turn decision-making into a conversation.

2/SEAGATE

The rise of social media and search engines caused data storage company Seagate's client base to expand and its product cycle sped up. New clients meant a peak in new services, which is hard to adapt to without efficient communication between parties. CrossLead trained staff to discuss decisions directly, not throw the problem between departments.

Sophia Epstein

Stanley McChrystal leads a corporate group on an early morning run across Washington DC



well as a pitch to potential new ones. There are top executives from companies such as Microsoft, Intuit, Seagate, Goldman Sachs, JPMorgan Chase and national security software provider SAP, as well as private equity firms, healthcare companies, oil and gas outfits and startups.

When McChrystal took over JSOC in 2003 – six months after the invasion of Iraq – his sole job was to capture or kill high-value targets such as Saddam Hussein, his sons and leaders of the Ba’athist regime. But quickly his mission changed. The period after the invasion gave rise to Al-Qaeda in Iraq, which devastated coalition troops with its hit-and-run tactics. JSOC’s mission changed to a deadly and frustrating game of finding an enemy that was largely hidden among civilians. “Here we are, we’re really good at fighting,” he says, “and we’re losing.”

The military had the best equipment any fighting force had ever had – technology that lets combatants fly faster, see in the dark and communicate via video uplinks. They had the internet, mobile phones and, for the first time in the history of combat, drones. They could see in real time what their bombs hit from the air. But they were applying this new technology using worn-out processes. “We had taken technology and applied it to a hierarchical structure that did not work,” says McChrystal.

To take out the bad guys, JSOC relied on warfare that had worked for centuries: find, fix, finish, exploit, analyse (a paradigm known as F3EA). The spies on the ground find the enemy. Signals intelligence, somewhere like GCHQ, listen to phone calls and geolocate them; special operations (Navy SEALs or the SAS)

finish (capture or kill) and exploit the intelligence found (mobile phones and laptops), sending it back to the intelligence agencies to be analysed. Once that data has been processed, new targets can be found, fixed and neutralised. The loop is supposed to be continuous and ongoing. That’s how you smash an enemy and win a war.

But when McChrystal arrived, the groups worked in silos. They didn’t share information. They hoarded it. The spooks doing the finding and fixing might pass on their intelligence, or they might not because it could kill off their sources of intelligence and data collection. The special-ops teams didn’t know why they hit a particular house and didn’t have enough background to know which people were key members of the enemy cells. “The raid force goes on target to a house and is told, ‘Pick up Dave,’” says McChrystal. “Dave’s not there, but Stan is there. So you leave and come back to base and somebody says to you later, ‘Well wait a minute, Stan *is* Dave’s boss.’ And you go, ‘Well, you didn’t tell us that. We didn’t know.’”

Worse, the raid teams didn't speak Arabic or Pashto so they couldn't read seized documents. Intelligence, in the form of phones, laptops and documents, was stuffed into a storage room at headquarters until it could be sent to the CIA headquarters in Langley, Virginia, for analysis. "When I took over, I went into this storeroom in Iraq and there's a huge stack of these plastic bags of documents," says McChrystal, still incredulous at his find. "I said, 'What is that?' They go, 'That's what we've captured and we're going to read them soon.' I said, 'Why don't we read them now?' And they said, 'We don't speak their language, have only got two interpreters and they do it in their spare time.' So stuff just sat there. And intelligence is worse than bananas. It goes bad fast and worthless quickly."

What McChrystal instituted in 2005 helped destroy Al-Qaeda. He started a daily 90-minute video teleconference, through secured satellite uplinks, that was open to anyone who wanted in, from the CIA director in Washington, DC to the Navy SEAL sergeant in theatre. It eventually drew 7,500 people a day – from the US to Iraq – so everybody now had a shared understanding of what was going on. He also moved the pilots who flew intelligence aircraft into living quarters near the raid teams who were going on the target. At last they could close the real-time raid loop.

Now, when special forces raided a target they knew the history of the house and everyone in it. They took biometric data (retinal scans and thumbprints) of everybody on target and seized information from phones and laptops and sent it straight to intelligence back at Bagram airfield or cryptographers at the NSA. "We could exploit the database of a laptop in real time," Silverman says. "We could say 'OK, here's all the things this person might know' and then interrogate them." An hour later they conducted a video conference from an intelligence garage at HQ, presenting their findings to the intelligence team there, across Iraq and back at Langley. "The analysts could point and say, 'Who had that? Where did you find it? What does it mean? You captured Stan, ask him this. He ought to know who and where this guy is,'" McChrystal says.

Special-ops team raids grew from about one every other night, in 2004, to four a night in 2006, according to McChrystal. "We were dropping the throttle and maxing out," Silverman says. "I could hit one target and then bounce to three others that night. We started pressing the fight and changing the environment."

McChrystal had changed JSOC culture from one where knowledge was power to one where sharing is power. In the process, he had given everyone an ownership stake in the results. He had increased productivity – with lethal effect. His teams called in the air strikes that killed Abu Musab al-Zarqawi, the notorious head of Al-Qaeda, in Iraq in 2006. (He personally accompanied his men to the bombed-out safehouse near Baqubah where he identified the body.) The next year, JSOC and CIA paramilitary units ran covert raids in tandem with the US's 30,000 troop surge, killing or capturing hundreds of senior Al-Qaeda leaders.



FROM DESK WORK TO FIELDWORK

Above: David Silverman, CEO of CrossLead. *Below, from top:* CrossLead's Sar-style room, where clients learn best-practice techniques; physical and team-building exercises



FIVE BATTLEFIELD TEACHINGS

Decision-making

Former US Navy pilot Laura Maasdam coaches clients on how to make decisions quickly by removing emotion and ego from the decision-making process.

Communication

Internal communication, especially through technology, can push everyone involved in a company to think as one.

Camaraderie

A basis of trust is key to the CrossLead protocol. Understand your own core values, how they relate to corporate values and those you are working with so that concerns can be worked through.

Leadership

Drills employed by CrossLead are intended to make bosses visualise the problems with their current system.

Teamwork

McChrystal thinks that if the whole team is responsible for the result then productivity will increase, as everyone contributes rather than just asking managers what to do. SE



'THERE'S THIS CONCEPT OF COURAGE. TO LEAD AND EXEMPLIFY IT, AND THEY KNOW HOW TO COMMUNICATE THOSE CAPABILITIES AND TO BRING THEM OUT IN OTHERS'

TODD BRADLEY, FORMER HEAD OF HP'S PRINTERS AND PC DIVISION

114

★ ★ ★ ★

All of which – the simplifying of complicated tasks, improved communication among far-flung divisions and increased productivity – resonates with big tech companies that are facing their own insurgencies in marketplaces. “We’ve been around 35 years and have to adapt constantly,” says Mark Whitby, senior vice president of hardware giant Seagate’s branded products group, who oversees a sales force of 350 people and splits his time between his home in London and the company’s California headquarters. “Our business model is changing rapidly thanks to cloud computing, and the product cycles get faster every day.”

Seagate had traditionally worked with the “big iron guys” such as IBM, which brands Seagate drives as its own. But the rise of social media and search meant that it was now selling to Google, Facebook and Alibaba. And those companies’ requirements – running massive server farms – were far different to what Seagate had done before. “They are much more interested in areas like cost per use, how much energy is this using in my data centre in terms of heat dissipation,” Whitby says. “And it’s a very different dialogue that we had to learn how to have.”

Whitby’s group accounted for 15 per cent of the company’s \$14 billion (£9bn) of annual sales in August 2012. With its business model under pressure, it called in McChrystal’s team 18 months ago. Ryan Faul, CrossLead’s director of operations, trouble-shooted with the sales and product units. What he found was a battle between two groups that had different objectives. Seagate’s sales team was paid by the number of units they sold. When a client asked for a discount on a large purchase, it seemed like a no-brainer. But the product planning division was in charge of setting prices and growing the company’s bottom line, and they baulked.

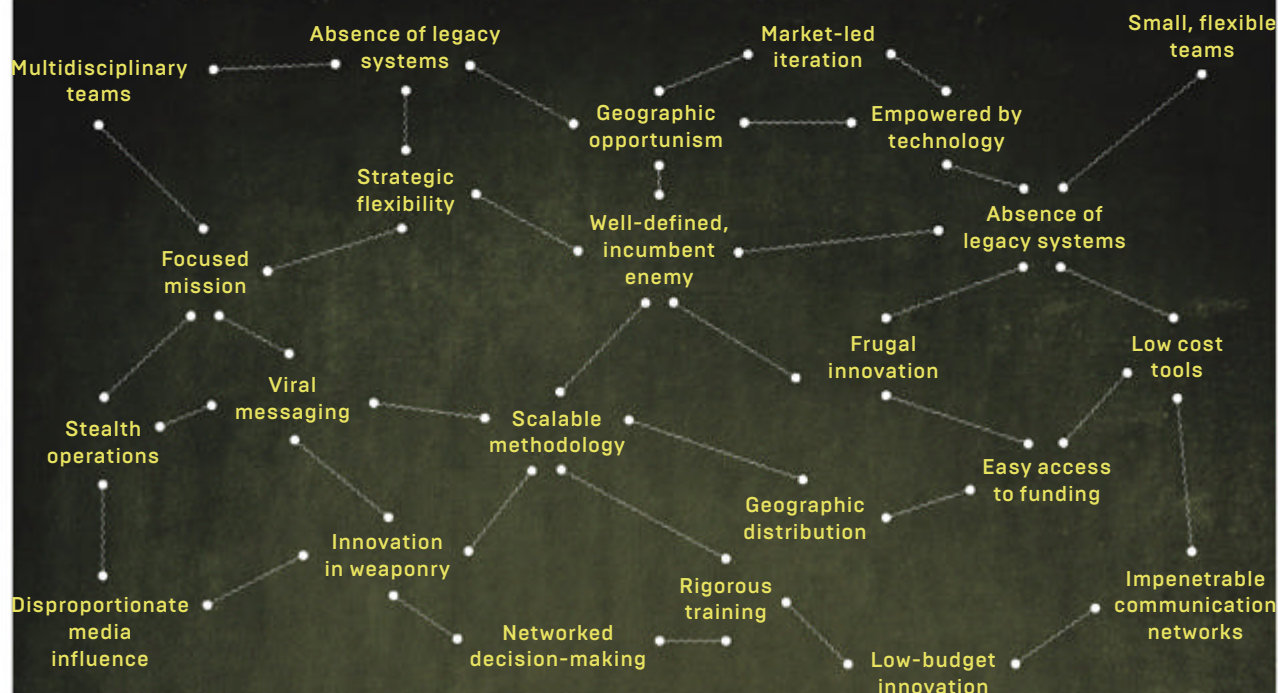
Laura Maasdam, a Harvard graduate and former US Navy pilot who flew Seahawk rescue helicopters, is an expert on the psychology of decision-making and negotiation tactics. She coached the Seagate executives on how to trust and talk to each other and take their emotions and egos out of their decision-making. As a leadership coach, she asks each executive: why are you here? What are your core values? What are your success metrics? Do they fit the corporate values? “We talk about trust, concrete behaviours and skills they need to incorporate in core principles,” she says.

“They were able to sit down and decide what was best for the organisation, align their interests. They closed a \$20 million deal in six days versus six weeks,” says Faul. Shared cultural values are as important to McChrystal’s teams as they are to their clients. “We feel aligned with them,” Whitby says. “They are capable people who have worked in very difficult situations and they engage quickly and deeply on a personal level.”

That internal drive and unwavering commitment is what led Bradley to work with CrossLead when he was at HP, and later at TIBCO Software, where he served as CEO before exiting late last year after it was sold for \$4.3 billion.

“These guys understand leadership in fast-paced, challenging environments,” Bradley says. “But there’s this concept of courage. To lead and exemplify it, and they know how to communicate those capabilities and to bring them out in others.”

FROM TERRORIST TO STARTUP...



...A NEW KIND OF ENEMY

★ ★ ★ ★

Shortly after 3pm, the executives at the CrossLead seminar break into teams and retreat to one of several conference rooms. Once there, Maasdam, Silverman and other CrossLead mentors run them through a role-playing exercise. Each person has to imagine they head a unit McChrystal oversaw – Navy SEALs, Army Deltas – or had to work with, such as the US Department of State or the CIA, and create a culture in which they could collaborate.

Maasdam's team works through the exercise, playing out the rivalries between the gung-ho SEALs and Army Deltas (whose primary tasks were to raid and neutralise targets), the State Department (the goal of which in Iraq increasingly became one of nation building) and the CIA (which wanted to withhold information that could put sources at risk). As they voice their unit's concerns and work together to identify their mindsets, agree on core principles and resolve differences, Robert Mitchell, a doctor with Carolinas HealthCare System, one of the largest healthcare networks in the US, has several breakthrough moments. "I keep shaking my head and thinking our people need these communication skills," says Mitchell, who helps to co-ordinate work among several diverse medical specialties.

Maasdam purses her lips and slowly nods her head. "Exactly," she says to the room. The point is clear: the consultancy's drills aim to help corporate decision-makers visualise the dysfunction within their own network of silos. CrossLead encourages clients to set up some form of Sar inside their operations, to deliver daily or weekly briefings to achieve shared consciousness and encourage buy-in.

Among the company's success stories – and its first client – is a business in the gardening sector. Scotts is not the kind of brand you'd associate with high-tech threats and challenges. It's a leader in the turf business, with sales of \$3 billion a year internationally. It's been around in one form or another since 1868. Its products, such as Miracle-Gro and Turf Builder Grass Seed, are ubiquitous in DIY stores. It's a hyper-seasonal business: 75 per cent of the company's annual sales happen in the six weeks from mid-March to the beginning of May. So it was a real problem when, in the spring of 2011, a small regional competitor attacked the quality of Scotts' grass seed in a series of damning TV and radio spots, and across social media.

"They basically said, 'Scotts is lying, our stuff is cheaper and better,'" says Barry Sanders, the company's COO and president. "And we thought, well, that's cute, but they're not going to keep doing that." But they did. It took Scotts 49 days to respond, during which time sales had eroded. "By the time we responded the damage was done," Sanders says. "We lost a couple of hundred basis points a share. That did not go well with our board. We had not thought through, 'If this type of thing happens, what do we do?'"

The digital media assault challenged Scotts' corporate decision-making process, the speed of which is crucial when a sales season is so short. Management devoted countless meetings to solving the crisis, convening for two hours each week, over seven weeks, to discuss and discard various strategies. "That's a lot of hours," says Will Smith, a 26-year-old CrossLead project manager on the Scotts account. A former PricewaterhouseCoopers strategy consultant for the US Department of Defense, Smith is a cavalry officer in the Army National Guard. "That's hundreds of thousands of dollars in executive pay being wasted as well," he says. "And they're not even fixing the problem."

McChrystal's team put in a system that helped executives make decisions quickly. One of his senior people, John Vines, a retired three-star general and former commander of the US Army's 82nd Airborne division in Afghanistan, joined Scotts' board. "One of the things they encourage is war gaming," Sanders says. "What

Laura Maasdam encourages CEOs and executives to distance themselves emotionally from the decision-making process



COMPANIES AT WAR

3/HP

Its former head of the printers and PC division, Todd Bradley, brought in McChrystal to learn military communication techniques in order to accelerate productivity. Because of the change and development of products and the way they are sold, they learned that discourse is the key to success.

4/INTUIT

The software giant, like many other legacy technology companies, is constantly looking over its shoulder for possible threats from startups. CEO Brad Smith used CrossLead to teach them techniques based on McChrystal's tactics against threats in Iraq, which called for fast and nimble performance. SE

if the battle doesn't turn out like we thought? What's our contingency plan?"

The company spent \$750,000 building a Sar room such as the one at CrossLead (with 18 42-inch flat screens) and 50 mini operations centres in seven counties, to conduct weekly meetings that were open to its 7,500 associates around the world, says Sanders. Now, with regular weekly video conference meetings, drawing 200 top executives, "We have a regular battle rhythm," Sanders says. "I become accessible to everybody and they can say: 'I understand why Sanders is saying this. Next time, I'll make the decision myself.'"

And that, McChrystal believes, is the entire point of CrossLead. "That's what leaders have to learn," he

says. "Technology allows people to send a request for every decision to a leader, through emails, mobile phones, texts. And he could make every decision. But he'd be quickly be flooded. And then you say, 'I'm here in the field, I could make a decision just as good as him.' The leader has to be humble enough to know how big his brain is. And if he's any good in his job he will push the great mass of decisions way down." ■

Kevin Gray wrote about the potential of urban farming and agri-tech in 10.14

YOU ARE

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**YOU'RE BORN
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IT WORK?'**

BY
KEVIN
ASHTON

A





ILLUSTRATION:
MIKE
MCQUADE

GENIUS

WHAT MAKES OUR

SPECIES

AND IS

DOMINANT

INNOVATION.

WHAT IS SPECIAL ABOUT US IS NOT THE SIZE

of our brains, speech, or the mere fact that we use tools. It is that each of us is in our own way driven to make things better. We occupy the evolutionary niche of new. The niche of new is not the property of a privileged few. It is what makes humans human.

We do not know exactly what evolutionary spark caused the ignition of innovation 50,000 years ago. It left no trace in the fossil record. We do know that our bodies, including our brain size, did not change – our immediate pre-innovation ancestor, *Homo sapiens*, looked exactly like us. That makes the prime suspect our mind: the precise arrangement of, and connections between, our brain cells. Something structural seems to have changed there – perhaps as a result of 150,000 years of fine-tuning.

Whatever it was, it had profound implications, and today it lives on in everyone. Behavioural neurologist Richard Caselli says: “Despite great qualitative and quantitative differences between individuals, the neurobiological principles of creative behaviour are the same from the least to the most creative among us.” Put simply, we all have creative minds.

This is one reason the creativity myth is so terribly wrong. Creating is not rare. We are all born to do it. If it seems magical, it is because it is innate. If it seems like some of us are better at it than others, that is

because it is part of being human, like talking or walking. We are not all equally creative, just as we are not all equally athletic, but we can all create.

The human race’s creative power is distributed in all of us, not concentrated in some of us. Our creations are too great and too numerous to come from a few steps by a few people. They must come from many steps by many people. Invention is incremental – a series of slight and constant changes. Some changes open doors to new worlds of opportunity and we call them breakthroughs. Others are marginal. But when we look carefully, we will always find one small change leading to another, sometimes within one mind, often among several, sometimes across continents or between generations, sometimes taking hours or days and occasionally centuries, the baton of innovation passing in an endless relay of renewal. Creating accretes and compounds, and as a consequence, every day, each human life is made possible by the sum of all previous human creations. Every object in our life, however old or new, however apparently humble or simple, holds the stories, thoughts and courage of thousands of people, some living, most dead – the accumulated news of 50,000 years. Our tools and art are our humanity, our inheritance and the everlasting legacy of our ancestors. The things we make are the speech of our species: stories of triumph, courage and creation, of optimism, adaptation, and hope; tales not of one person here and there but of one people everywhere; written in a common language, not African, American, Asian or European, but human.

There are many beautiful things about creating being human and innate. One is that we all create in more or less the same way. Our individual strengths and tendencies cause differences, but they are small and few relative to the similarities, which are great and many. We are more like da Vinci and Einstein than not. But it’s now business that needs help in fighting the new kinds of asymmetric challenges of the networked era.



THE RENAISSANCE BELIEF THAT CREATING

is reserved for genius survived through the Enlightenment of the 17th century, the Romanticism of the 18th century and the Industrial Revolution of the 19th century. It wasn’t until the middle of the 20th century that the alternative position – that everyone is capable of creation – first emerged.

In the 40s, the brain was an enigma. The body’s secrets had been revealed, but the brain, producing consciousness without moving parts, remained a puzzle.

As the west recovered from world war II, new technologies appeared. One was

the computer. This mechanical mind made understanding the brain seem possible for the first time. In 1952, Ross Ashby synthesised the excitement in a book called *Design for a Brain*. He summarised the new thinking elegantly: “The most fundamental facts are that the Earth is over 2,000,000,000 years old and that natural selection has been winnowing the living organisms incessantly. As a result they are today highly specialised in the arts of survival, and among these arts has been the development of a brain, an organ that has been

developed in evolution as a specialised means to survival. The nervous system, and living matter in general, will be assumed to be essentially similar to all other matter. No *deus ex machina* will be invoked."

Put simply: brains don't need magic.

A San Franciscan named Allen Newell came of academic age during this period. He abandoned his plan to become a forest ranger (his first job was feeding gangrenous calves' livers to fingerling trout) to become a scientist instead. One Friday afternoon in November 1954, he experienced what he would later call a "conversion experience" during a seminar on mechanical pattern recognition. He decided to devote his life to a single question: "How can the human mind occur in the physical universe?"

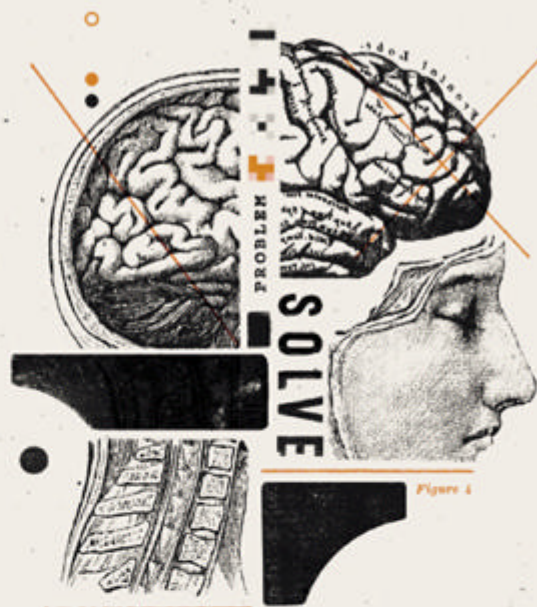
"We now know that the world is governed by physics," he explained, "and we now understand the way biology nestles comfortably within that. The issue is how does the mind do that as well? The answer must have the details. I've got to know how the gears clank, how the pistons go and all of that." As he embarked on this work, Newell became one of the first people to realise that creating did not require genius. In a 1959 paper called *The Processes of Creative Thinking*, he reviewed what little psychological data there was about creative work, then set out his radical idea: "Creative thinking is simply a special kind of problem-solving behaviour." He made the point in the understated language academics use when they know they are on to something: "The data currently available about the processes involved in creative and non-creative thinking show no particular differences between the two. Creative activity appears simply to be a special class of problem-solving activity characterised by novelty, unconventionality, persistence and difficulty in problem formulation."

It was the beginning of the end for genius and creation. Making intelligent machines forced new rigour on the study of thought. The capacity to create was looking more and more like an innate function of the human brain – no genius necessary. Newell did not claim that everyone was equally creative. Creating, like any human ability, comes in a spectrum of competence. But everybody can do it. There is no electric fence with genius on one side and the general population on the other.

Newell's work, and that of others in the artificial-intelligence community, undermined the myth of creativity. As a result, some of the next generation of scientists started to think about creation differently. One was Robert Weisberg, a cognitive psychologist at Philadelphia's Temple University.

Weisberg was an undergraduate during the first years of the artificial-intelligence revolution, spending the early 60s in New York before getting his PhD from Princeton and joining the faculty at Temple in 1967. He spent his career proving that creating is innate, ordinary and for everybody. Weisberg's view is simple. He builds on Newell's contention that creative thinking is the same as problem solving, then extends it to say that creative thinking is the same as thinking in general, but with a creative result. In Weisberg's words, "when one says of someone that he or she is 'thinking creatively', one is commenting on the outcome of the process, not on the process itself. Although the impact of creative ideas and products can sometimes be profound, the mechanisms through which an innovation comes about can be very ordinary."

Said another way, normal thinking is rich and complex – so rich and complex that it can sometimes yield extraordinary, or "creative", results. **We do not need other processes. Weisberg shows this in two ways: with carefully designed experiments and detailed case studies of creative acts – from the painting of Picasso's *Guernica* to the discovery of DNA and**



NORMAL THINKING IS RICH AND COMPLEX – SO RICH AND COMPLEX THAT IT CAN YIELD EXTRAORDINARY RESULTS

the music of Billie Holiday. In each example, by using a combination of experiment and history, Weisberg demonstrates how creating can be explained without resorting to genius and great leaps of the imagination.

Weisberg's work, with subtitles such as *Genius and Other Myths* and *Beyond the Myth of Genius*, did not eliminate the magical view of creation nor the idea that people who create are a breed apart. It is easier to sell secrets. Titles available in today's bookstores include *10 Things Nobody Told You About Being Creative*, *39 Keys to Creativity*, *62 Exercises to Unlock Your Most Creative Ideas* and *100 What-Ifs of Creativity*. Weisberg's books are out of print. The myth of creativity does not die easily.

But it is becoming less fashionable, and Weisberg is not the only expert advocating for an epiphany-free, everybody-can theory of creation. Ken Robinson was awarded a knighthood for his work on creation and education, and is known for the moving, funny talks he gives at TED. One of his themes is how education suppresses creation. He describes "the really extraordinary capacity that children have, their capacity for innovation." Robinson's conclusion is that "creativity now is as important in education as literacy, and we should treat it with the same status." Cartoonist Hugh MacLeod makes the same point more colourfully: "Everyone is born creative; everyone is given a box of crayons in kindergarten. Being suddenly hit years later with the 'creative bug' is just a wee voice telling you, 'I'd like my crayons back, please.'"



THE PSYCHOLOGIST KARL DUNKER

was the creator of the “candle problem”, a test where the subject is given a candle, a box of tacks and a book of matches. The task was to attach the candle to a wall – the solution was using the tacks to pin the box to the wall, and use it as a shelf, but most people couldn’t see past the box as being anything more than a receptacle for tacks. Duncker also wrote that the act of creation starts with one of two questions:

“Why doesn’t it work?” or, “What should I change to make it work?”

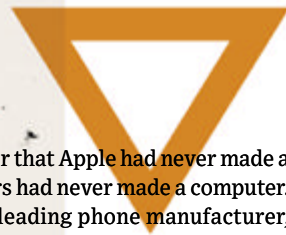
These sound simple, but answering them can lead to extraordinary results. One of the best examples comes from Steve Jobs, cofounder and CEO of Apple. When Jobs announced Apple’s first mobile phone, the iPhone, in 2007, he said: “The most advanced phones are called smart-phones. They are definitely a little smarter, but they actually are harder to use. They all have these keyboards that are there whether you need them or not. How do you solve this? We solved it in computers 20 years ago. We solved it with a screen that could display anything. What we’re going to do is get rid of all these buttons and just make a giant screen. We don’t want to carry around a mouse. We’re going to use a stylus. No. You have to get them and put them away, and you lose them. We’re going to use our fingers.”

It is no coincidence that Jobs sounds like one of Duncker’s subjects thinking aloud while trying to attach a candle to a wall. The step-by-step process is the same. Problem: smarter phones are harder to use because they have permanent keyboards. Solution: a big screen and a pointer. Problem: what kind of pointer? Solution: a mouse. Problem: we don’t want to carry a mouse around. Solution: a stylus. Problem: a stylus might get lost. Solution: use our fingers.

Apple sold four million phones in 2007, 14 million in 2008, 29 million in 2009, 40 million in 2010, and 82 million in 2011, for a total of 169 million sold in its first five years in the phone business, despite charging a higher price than its competitors did. How?

For several years, starting around 2002, I was a member of the research advisory board of a company that made mobile phones. Every year it gave me its latest phone. I found each one harder to use than the last, as did other board members. It was no secret that Apple might enter the mobile phone market, but the risk was always dismissed, since Apple had never made a phone. A few months after Apple’s phone became available, my board met and I asked what the company thought of it. The chief engineer said, “It has a really bad microphone.”

This was true, irrelevant and revealing. This company thought smartphones were phones, only smarter. They had made some of the first mobile phones, which, of course, had buttons on them. These had been successful. So, as they added smarts, they added buttons. They thought a good phone provided a good phone-call and the smart stuff was a bonus. Apple made computers. For Apple, as Jobs’s announcement made clear, a smartphone was not a phone. It was a computer for your pocket that, among other things, made calls. Making computers was a problem that Apple, as Jobs described it, had



“solved” 20 years ago. It did not matter that Apple had never made a phone. It did matter that phone makers had never made a computer. The company I was advising, once a leading phone manufacturer, lost a large amount of money in 2007, saw its market share collapse and was eventually sold.

“Why doesn’t it work?” deceives us with its simplicity. The first challenge is to ask it. The chief engineer did not ask this question about his phones. He saw rising sales and happy customers and so assumed that nothing was broken and there was nothing to fix.

But Sales + Customers = Nothing Broken is a formula for corporate cyanide. Most big companies that die kill themselves drinking it. Complacency is an enemy. “If it ain’t broke, don’t fix it” is an impossible idiom. No matter the sales and customer satisfaction, there is always something to fix. Asking, “Why doesn’t it work?” is creation inhaling. Answering is creation breathing out. Innovation suffocates without it.

“Why doesn’t it work?” has the pull of a pole star. It sets creation’s direction. For Jobs and the iPhone, the critical point of departure was not finding a solution but seeing a problem: the problem of keyboards making smarter phones harder to use. Everything else followed.

THE SECRET OF STEVE JOBS WAS THAT HE WAS NEVER SATISFIED. HE DEVOTED HIS LIFE TO ASKING, ‘WHY DOESN’T IT WORK?’ AND ‘WHAT SHOULD I CHANGE TO MAKE IT WORK?’



Apple was not unique. Korean electronics giant LG launched a product much like the iPhone before the iPhone was announced. The LG Prada had a full-sized touchscreen, won design awards, and sold a million units. When Apple's very similar direction – a big touchscreen – was revealed, competitors built near replicas within months. These other companies could make an iPhone, but they could not conceive one. They could not look at their existing products and ask, “Why doesn't it work?”

The secret of Steve was evident in 1983, during the sunrise of the personal computer, when he spoke at a design conference in Aspen, Colorado. There was no stage, and there were no visual aids. Jobs stood behind a lectern with yearbook hair, a thin white shirt, its sleeves folded as far as his forearms, and – “they paid me 60 dollars, so I wore a tie” – a pink-and-green bow tie. The audience was small. He gestured widely as he envisioned “portable computers with radio links”, “electronic mailboxes”, and “electronic maps”. Apple Computer, of which Jobs was then cofounder and a director, was a six-year-old startup playing David to IBM's Goliath. Apple's sling was sales; it had sold more personal computers than any other company in 1981 and 1982. But despite his optimism, Jobs was dissatisfied: “If you look at computers, they look like garbage. All the great product designers are off designing automobiles or buildings but hardly any of them are designing computers. We're going to sell ten million computers in 1986. Whether they look like a piece a shit or they look great. There are going to be these new objects in everyone's working environment, in everyone's educational environment, in everyone's home environment. And we have a shot at putting a great object there. Or if we don't, we're going to put one more piece of junk there. By 1986 or 1987 people are going to be spending more time interacting with these machines than they spend in a car. And so industrial design, software design and how people interact with these things must be given the consideration that we give automobiles today, if not a lot more.”

Twenty-eight years later, Walt Mossberg, technology columnist for the *Wall Street Journal*, described a similar discussion that happened near the end of Jobs's life: “One minute he'd be talking about sweeping ideas for the digital revolution. The next about why Apple's current products were awful and how a colour, or angle, or curve, or icon was embarrassing.”

A good salesman sells everybody. A great salesman sells everybody but himself. What made Steve Jobs think different was not genius, passion, or vision. It was his refusal to believe that sales and customers meant nothing was broken. He enshrined this in the name of the street encircling Apple's campus: Infinite Loop. The secret of Steve was that he was never satisfied. He devoted his life to asking, “Why doesn't it work?” and “What should I change to make it work?”

UT HANG ON. SURELY THERE IS AN ALTERNATIVE TO STARTING BY ASKING, “Why doesn't it work?” What if you simply start with a good idea?

Ideas are a staple of myths about creating; they even have their own symbol, the light bulb. That comes from 1919, the age of silent movies, a decade before Mickey Mouse, when the world's favourite animated animal was Felix the Cat. Symbols and numbers would appear above his head, and sometimes he would grab them to use as props – question marks became ladders, musical notes became vehicles. One symbol lived long after the cat: when Felix had an idea, a light bulb appeared above his head. They have represented ideas ever since. Psychologists adopted the image: after 1926, they often called having an idea “illumination”.

The creativity myth confuses having ideas with the actual work of creating. Books with titles such as *Making Ideas Happen* and *How to Get Ideas* emphasise idea generation, and idea-generation techniques abound. The most famous is brainstorming, invented by advertising executive Alex Osborn in 1939 and first published in 1942 in his book *How to Think Up*.

Research into brainstorming has a clear conclusion. The best way to create is to work alone. The worst way to create is to work in large groups and defer criticism. Steve Wozniak, Steve Jobs's cofounder at Apple and the inventor of its first computer, offers the same advice: “Work alone. You're going to be best able to design revolutionary products and features if you're working on your own. Not on a committee. Not on a team.”

Brainstorming fails because it is an explicit rejection of ordinary thinking – all leaps and no steps – and because of its unstated assumption that having ideas is the same as creating. Partly as a result, almost everybody has the idea that ideas are important.

Ideas are like seeds: they are abundant and most of them never grow into anything. Also, ideas are seldom original. Ask several independent groups to brainstorm on the same topic at the same time, and you will likely get many of the same ideas. This is not a limitation of brainstorming; it is true of all creation. Because everything arises from steps, not leaps, most things are invented in several places simultaneously. For example, four different people discovered sunspots independently in 1611; five people invented the steamboat between 1802 and 1807; and two people invented the silicon chip in 1957. When political scientists William Ogburn and Dorothy Thomas studied this phenomenon, they found 148 cases of big ideas coming to many people at the same time and concluded that their list would grow longer with more research.

Having ideas is not the same thing as being creative. Creation is execution, not inspiration. Many people have ideas; few take the steps to make the thing they imagine. One of the best examples is the aeroplane. The brothers Orville and Wilbur Wright were not the first people to have the idea of building a flying machine, nor were they the first people to begin building one, but they were the first people to fly. ▣

Kevin Ashton cofounded the Auto-ID Center at MIT and coined the term “internet of things”. This extract is from his new book, *How To Fly A Horse: The Secret History of Creation, Invention and Discovery* (William Heinemann), out now

Microsoft

Many errors have occurred.

Face up to the reality of
and the decline of the PC.

Then press SATYA+NADELLA to

Execute: a new computing
holographic goggles

Press any key to continue...

To continue:

mobile apps, cloud computing
transform the company's culture.
platform built around crazy

A black and white portrait of Satya Nadella, CEO of Microsoft. He is wearing glasses and a dark blazer over a dark shirt. He is looking slightly upwards and to the right with a thoughtful expression. His right hand is resting on his lap, with fingers slightly curled. The background is plain white.

Microsoft in the
age of Satya Nadella

By **Jessi Hempel**

Photography: **Platon**

Restart

On a campus notable for tight security and secret offices, Building 92 is a rare beacon of openness.

Guests can enter without a Microsoft ID and browse corporate history in the visitor centre or pop into the company store for branded water bottles, onesies, and “My Mom is a geek” T-shirts. And yet, directly beneath them, tucked away in the basement, there is a lab so confidential that even most employees have never heard of it. Alex Kipman flashes his badge across the access pads to a set of double doors and bounds down the stairs.

Over the past five years, Kipman and a team of Microsoft engineers, designers and researchers have toiled in this windowless space to create a top-secret product that might be the company’s most ambitious since the 2010 release of the motion-sensing gaming device Kinect: an augmented-reality headset codenamed Project HoloLens. The device – a kind of face-computer that looks like a pair of space-age sunglasses – is a bit like the Oculus Rift virtual reality headset. But while the Rift immerses its wearers in a completely digital environment, Project HoloLens weaves digital elements into the real world – a magical merging of the virtual and physical.

Over the next couple of hours I play a game where a character jumps around a real room, collecting coins sprinkled atop a sofa and bouncing off springs placed on the floor. I sculpt a virtual toy (a fluorescent-green snowman) that I can then produce with a 3D printer. I collaborate with a motorcycle designer Skyping in from Spain to paint a three-dimensional fender atop a physical prototype. I traverse the surface of Mars with a Nasa scientist.

But it’s a much more mundane task that really gives me a sense of Project HoloLens’s

■ **Wipeouts**
Microsoft has a long history of flops. Here’s a sampling.
Jason Kehe

1996
Windows CE

2004
SPOT smartwatch

2006
Zune MP3 player

2007
Windows Vista

2007
Mediaroom entertainment system

2010
Kin phone

2010
Docs.com

potential: fixing a light switch. Kipman places the headset on me, and points me towards a 7.5cm-wide hole in the wall with wires jutting out of it and a nearby sideboard topped with unfamiliar tools. (As is perhaps obvious, I’m no electrician.) An engineer pops up on my screen, Skyping in from another room, and introduces himself. He can see exactly what I’m seeing. He draws a holographic circle around a voltage tester atop the sideboard. Then he walks me through the process of installing the switch, coaching me and sketching quick holographic arrows and diagrams that glow on the wall in front of me. Five minutes later, I flip a switch and the living-room light turns on.

Project HoloLens is extremely ambitious, and it’s the first major test of whether Microsoft’s new CEO, Satya Nadella, can restore the company’s long-dormant reputation for innovation and creativity. Nadella, 48, brings a fresh leadership style to the job, pairing the institutional knowledge he acquired over more than two decades at Microsoft with

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Project HoloLens
chief inventor
Alex Kipman





Executive
vice
president
Qi Lu

a collaborative, nice-guy approach to management. “He has allowed ideas to bloom and be considered,” says Terry Myerson, the executive in charge of Windows, who has been with the company since 1997. “That’s hard to do with big groups of people.”

When Microsoft was founded, its ambitious mission to power a personal computer on every desk in every home seemed as radical as Project HoloLens does today. But 40 years later, the going perception in Silicon Valley is that the company’s best days are behind it. In a public conversation with entrepreneur and

software engineer Marc Andreessen in October, investor Peter Thiel called Microsoft a bet “against technological innovation”. Though Microsoft still makes an awful lot of money – sales revenue jumped almost 12 per cent to \$86 billion (£55bn) last year – its core business is declining, a dynamic that was set in motion more than a decade ago, when nearly every enterprise owned and ran Windows-powered PCs and servers.

Microsoft’s fall stems from its attempts to lock users into its products by refusing to work with competitors. Lost in the hubris that

can come with market dominance, the company launched a series of me-too hardware products, figuring loyalists would embrace them. There was the Zune MP3 player that followed the iPod, the Surface tablet that replicated the iPad, and the Kin, a much-hyped 2010 phone designed for social networking that was on sale for just 48 days before Microsoft and Verizon killed it. Consumers turned to better-designed devices that were plugged into other software ecosystems where Microsoft had no stake, rendering the company irrelevant. Meanwhile, the computing industry was changing. Processing increasingly happened in the cloud, and businesses rented the software they used. Users began to shift more of their work to mobile devices, most of them powered by Apple’s iOS and Google’s Android. In 2014, Microsoft accounted for an estimated four per cent of the global market share for smartphone operating systems. In the “mobile first, cloud first” world that Nadella is fond of referencing, Microsoft missed mobile and came late to the cloud.

This was the state of affairs that Nadella faced when he took the top job a year ago. In an early analyst call, he quoted philosopher Friedrich Nietzsche, saying Microsoft must have “courage in the face of reality”. Since then, he has been doing just that. His predecessor Steve Ballmer described Microsoft as a devices and services company. Nadella has scrapped that, casting it instead as a company capable of working across any platform – even those controlled by competitors – to help people be more productive. He has made Office software available on Apple- and Google-powered tablets and phones, and made Windows free to manufacturers of devices smaller than nine

inches. He has forged new partnerships with companies Microsoft once considered enemies and spent time with startups to learn how innovative business models work. And he paid \$2.5 billion for *Minecraft* maker Mojang, so that a new generation will grow up on Microsoft's software.

But Project HoloLens is by far the boldest – and riskiest – move of the Nadella era. It's not another me-too product but a truly unique experience. It's also the kind of project that few besides Microsoft would undertake – a lavish, multi-year effort that builds on lots of in-house research, all in service of extending the reach of Windows. Nadella believes that Project HoloLens is nothing less than the emergence of the next computing interface, saying, "It's like the first time you used Excel on a PC with a mouse and a keyboard" (a transformative experience that perhaps only a longtime Microsoft exec can cite). More significant for Nadella, even though Project HoloLens has been in the works since long before he ascended to CEO, it will define the first

years of his tenure – heralding either a new era of innovation at Microsoft or another regrettable chapter in the story of a company in decline.

Satya Nadella is drawing me a picture of Microsoft. We're in his office, the same simple square of Building 34 previously occupied by Ballmer, and before him Bill Gates, and the furniture doesn't seem to have changed much – the same Ikea shelves line the walls. Still, there are some indications that signal the arrival of a new occupant. For one thing, there's an empty iPad mini box lying open on his desk. A cricket bat rests right next to it.

Nadella squats in front of a dinged-up black laminate coffee table and sketches three concentric circles on a piece of scrap paper. A wiry man with a shaved head and black-framed spectacles, he has a voice with a range of octaves but only one moderate volume. The outer ring, he explains,

is Concepts – the vision that allows the company to think up new things like Project HoloLens. Inside this, he labels the second circle Capabilities – the engineering and design skills necessary to make things. Nadella pauses on the smallest circle, the centre of the bull's-eye, which he labels Culture.

"You need a culture that is fundamentally not opposed to new concepts and capabilities," he says.

Microsoft has had no problem with the outer circles. It has combined vision with breathtaking engineering to create a whole bunch of amazing prototypes. But they rarely make it to market. That's because, over the past two decades, its culture has grown competitive and insular, more consumed with getting and protecting an edge than pushing into riskier new businesses. People were motivated to produce things they knew their managers would like, rather than take risks on new ideas that might fail. The company's money-minting core offerings, Windows and Office, sucked up talent and attention while newer ideas were being

Redmond missed mobile

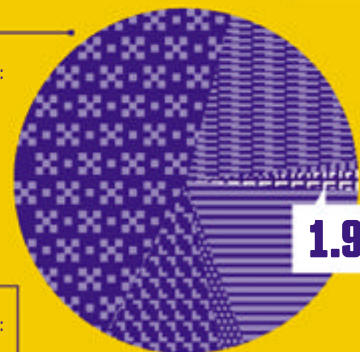
The old Microsoft never gained turf in smartphone operating systems. As users migrated to mobile globally, the company was quickly overtaken by Google and Apple. **JK**



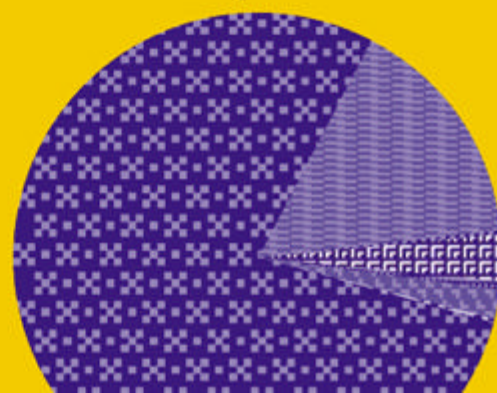
2009
Total unit sales:
172.4 million



2011
Total unit sales:
472.9 million



2013
Total unit sales:
967.8 million



SOURCE: GARTNER

overlooked. Under former CEO Ballmer, employees were expected to live the Microsoft lifestyle, using Windows-powered phones and Surface tablets even when the bulk of the innovation was happening on iOS and Android devices. Says one veteran: "I think there's a lot of people that really felt, you know, maybe like Detroit does. You drive American."

It has become something of an accepted wisdom in Silicon Valley that large, successful technology companies can't reinvent themselves. Many have attempted to engineer comebacks, and the industry is teeming with failed empires that have evolved into middling businesses on the decline: BlackBerry. Hewlett-Packard. Yahoo! But Nadella finds inspiration in an example closer to home: Microsoft itself. He remembers sitting in a waiting room at Goldman Sachs in 1992, trying to meet an underling of the chief information officer. He never did get in, because Goldman Sachs, like everyone else at the time, thought of Microsoft as a company that only sold software for your home computer.

"They wouldn't even bother to see Microsoft people, saying, 'What the heck do PC people have to do with us?'" Nadella recalls. He lets a pause settle between us, prompting me to reflect on the rise of enterprise computing, which enabled Microsoft to embed its Office software in practically every business in the world. "And so things change," he concludes.

Although Nadella developed much of his management approach on the job, his clarity of vision and empathetic listening style trace their roots to a formative personal event. He'd arrived at Microsoft in 1992 with a master's degree in computer science from the University of Wisconsin-Milwaukee (he'd later earn an MBA from the University of Chicago). He was newly married to a woman he'd met in high school back in Hyderabad, India, where they grew up. For the first few years at Microsoft, Nadella was on the fast track, progressing quickly through the ranks. Then

Satya Nadella opened an in-house tinkering group to the public so outsiders could test its ideas

Zain, the first of his three children, was born profoundly disabled. The reality that Zain would be confined to a wheelchair set in. Initially Nadella asked himself, "Why us? Why did this happen to us?" But after a couple of years, his perspective shifted. "We realised this has nothing to do about us and everything to do about him," he says. His son's condition helped him see beyond himself and compelled him to force-rank his daily priorities so that he could meet his son's needs and still perform his job - the same skill so necessary for effective management. The experience held other lessons too. "I think back to how I thought about work before and after, and this notion of the words you say and what they can do to the other person," he says, referring to his interactions with his wife and son. "How can you really change the energy around you? It's a thing that started building in me, and I started exercising it in my day job. It made a lot of difference to how I felt when I went back home. So much of it is mental attitude." He keeps a black-and-white headshot of Zain beneath his monitor, his son's head thrown back, laughing.

Long before he was CEO, this approach helped Nadella start to build a new culture amid seemingly immutable circumstances without

making enemies. For example, when he wanted to start a cloud-computing business - which would mean borrowing technology from the search engine Bing - he ran up against Microsoft's powerful SQL server business. Normally the SQL team would have instantly squashed Nadella's initiative. But Nadella persisted, eventually convincing the server group that the rise of cloud computing was inevitable. "He won that battle," says James Staten, an analyst with Forrester who has covered Microsoft for more than a decade. "It was a huge political shift."

As CEO, Nadella has restructured Microsoft to function more like the Silicon Valley companies that have eclipsed it. To be fair, it's a process Ballmer put in motion in the summer of 2013 when he reorganised the company into cross-functional teams, abolishing the powerful product divisions for a flatter, more integrated approach he called One Microsoft. Nadella has streamlined these teams, cutting 14

per cent of the staff. He has eschewed Microsoft's traditional R&D cycle, in which products went through a testing phase after development, in favour of a fast-moving process in which these steps happen in tandem. To foster experimentation, the company opened Garage – a 32-chapter group of in-house tinkerers – to the public so outsiders could test Microsoft's ideas.

Nadella's new philosophy extends to the org chart, where he's empowering his executives to work across once-siloed divisions. He has named Julie Larson-Green, formerly the executive vice president in charge of devices such as Xbox and Surface, to a new role: chief experience officer. Judging narrowly by the org chart, it was a demotion, since she now reports to Qi Lu, one of Nadella's deputies and head of the Applications and Services Group, instead of directly to Nadella. But in many ways, it's a bold experiment that puts Larson-Green at the forefront of Nadella's new approach to development. Larson-Green now determines how Microsoft's products, from Xbox to Office, can better support one another and also perhaps work with other companies' popular apps and services. This shift, which sets an important precedent for other Microsoft employees, seems to have worked because Nadella, Lu and Larson-Green share common goals and, they say, a trust that runs deep enough to allow for a flatter hierarchy. (Indeed, earlier in his career, Nadella actually reported to Lu.)

To motivate people, Nadella asked Bill Gates to spend 30 per cent of his time as technical adviser to the company. Nadella sees the moral authority of the founder as a critical management tool. "When I say, 'Hey, I want you to go run this by Bill,' I know they're going to do their best job prepping for it," he says. Gates is not a regular at management meetings, however. He interacts primarily with senior staff, including Qi Lu, offering feedback on Microsoft's technical work.

Nadella also revised Microsoft's approach to research and development. The company has long spent upwards of 11 per cent of its revenue on this area, and it has had a reputation for investing in the type of blue-sky undertakings that may not see a

commercial outlet. Take Microsoft Courier, a 2008 booklet PC with touchscreens that faced each other; the ill-fated device never made it out of the lab. (Its team left afterwards and later founded FiftyThree, the design startup behind the iPad app *Paper* and digital stylus *Pencil*.) Nadella has pushed researchers to collaborate much more closely with engineers in other departments to help them get products out faster. The release of Microsoft's Skype Translator, which

translates multilingual conversations in real time, is an early success. Nadella calls Skype Translator "a moment of truth" because it required groups of people to work across divisions, combining features from the Skype team, the Azure cloud-computing team and the Office teams. That's the kind of co-operation that never happened in the old Microsoft. ■

Jessi Hempel (@jessiwrites) is a senior staff writer at US WIRED

Nasa JPL scientist Jeff Norris – an early adopter of Project HoloLens



Project Ho



Inside the headset

1. CAMERA

The Project HoloLens depth camera has a field of vision that spans 120 x 120 degrees, far more than the original Kinect, while drawing only a fraction of the power.

2. COMPUTER

As many as 18 sensors flood the brain of the device with terabytes of data every second. It handles the onslaught with an onboard CPU, GPU and first-of-its-kind HPU (holographic processing unit).

3. LENSES

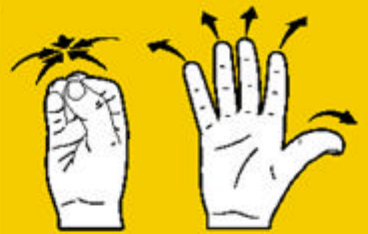
To trick your brain into perceiving holographic images at make-believe distances, light particles bounce around millions of times in the "light engine". Then the photons enter the two lenses (one for each eye), where they ricochet between layers of blue, green and red glass before reaching your eye.

4. VENTS

The device is more powerful than a laptop but won't overheat – warm air flows to the sides, venting out.

It's
controlled
with
gestures,
gaze
and
voice
commands

Interface



GESTURES

Engineers are fine-tuning a feature called "holding" that would allow you to grasp and manipulate holographic objects. Opening your hand would take you back to a home screen.



VOICE

Microphones built into the headset capture voice commands.



GAZE

Sensors track where the wearer is looking and adjust the display.

HoloLens

Microsoft's augmented-reality goggles merge the physical world with virtual reality. By Jason Kehe

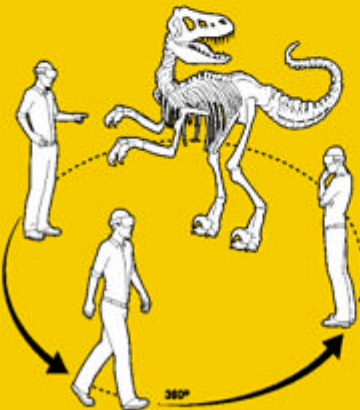
133



■ Uses

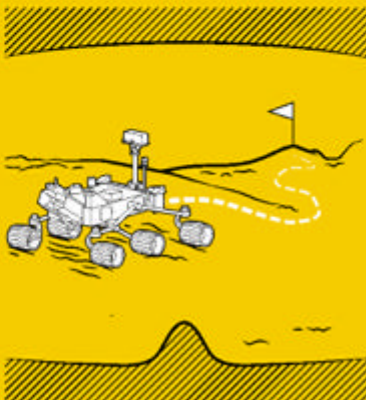
HOLOGRAMS

The device can project a hologram into a room and keep it locked in position – an essential feature its engineers call “pinning”. Instead of the object moving relative to you, you can move around the object and view it from any angle. In the case of this holographic raptor, that means it’s easy to stay just beyond its scary reach.



VIRTUAL ENVIRONMENTS

Project HoloLens can simulate a physical space – such as the surface of Mars, complete with the Curiosity rover. Once inside the environment, scientists can interact with objects and overlay the space with virtual flags. For example: placing a flag in the distance could, theoretically, tell the real rover to go there and collect a soil sample.



AUGMENTED REALITY

The device scans your environment and builds a digital model in real time. Then, if you’re playing a game, a character from the game can frolic as a hologram around your living room. Project HoloLens not only knows the couch is there, it also sees that it’s made of leather – and is much cushier than, say, your wooden floor.



P

PROJECT HOLOLENS' CHIEF

inventor, Alex Kipman, is representative of the Microsoft that Nadella is trying to build. Although his official title is technical fellow with the Operating Systems Group, he works collaboratively across disciplines. Nadella appreciates his versatility. "Alex is pretty crazy in the sense that he's not like your classic engineering guy," he says, drawing a distinction between the predictability of typical engineers and the imaginative quality of their researcher counterparts. "He sort of thinks of engineering as a research project."

Kipman, who was born in Brazil, started young. His parents had to replace his Atari 2600 twice because he kept breaking it to figure out how it worked. He landed at Microsoft after graduating from Rochester Institute of Technology, and by the end of 2007 he'd dreamed up Kinect, the motion-sensing accessory for the Xbox. "When I pitched Kinect to the company, it wasn't Kinect. It was this vision," he tells WIRED, holding up an early prototype for Project HoloLens. "Kinect was the first step."

Kipman fervently believes Project HoloLens will be to this phase of computing what the PC was to the last: the latchkey to a completely transformed world. In this new reality, sensors will be everywhere, producing copious amounts of data, providing a layer of ambient intelligence coating every physical object. Project HoloLens and its counterparts will offer a visual computing platform controlled by speech and gesture that is so intuitive it fades into the background. "So you and I can do what we're put on Earth to do: interact with other humans, environments or objects," Kipman says. "With technology helping us do that more, better, faster, and cheaper."

Project HoloLens is built, fittingly enough, around a set of holographic lenses. Each lens has three layers of glass - in blue, green and red - full of micro-thin corrugated grooves that diffract light. There are multiple cameras at the front and sides of the device that do everything from head tracking to video capture.

And it can see far and wide: the field of view spans 120 degrees x 120 degrees, significantly bigger than that of the Kinect camera. A "light engine" above the lenses projects light into the glasses, where it hits the grating and then volleys between the layers of glass millions of times. That process, along with input from the device's myriad sensors, tricks the eye into perceiving the image as existing in the world beyond the lenses.

The device has just three controls: one to adjust volume; another to adjust the contrast of the hologram; and a power switch. Its speakers rest just above your ears. Project HoloLens can determine the direction from which a sound originates, so that when you hear something, it'll appear to be coming from where it would be in real life. If a truck is meant to be speeding by your left side, for example, that's where you'll hear the sound of its engine. By the time Project HoloLens comes to market toward the end of this year, it'll weigh about 400 grams, or about the same as a high-end bike helmet. Microsoft's new operating system, Windows 10, powers it, so any developer can program for it.

Nasa has already gotten an early crack at it. As the mission operations innovation lead at the agency's Jet Propulsion Laboratory, Jeff Norris is charged with rethinking how we explore space, with a focus on the interface between humans and technology. He met Kipman nearly five years

Meet the new guy

Highlights from Nadella's busy first year as CEO. JK

FEBRUARY 4
Asks Bill Gates to spend 30 per cent of his time as technology adviser.

FEBRUARY 24
Names Julie Larson-Green chief experience officer.

MARCH 27
Office hits the iPad.

APRIL 2
Windows goes free for sub-9" devices.

MAY 29
Partners with Salesforce, a long-time competitor.

SEPTEMBER 15
Buys *Minecraft* maker Mojang for \$2.5 billion.

OCTOBER 9
Apologises for discouraging women from asking for raises.

OCTOBER 22
Microsoft's idea factory, Garage, lets the public in.

NOVEMBER 12
The .NET software framework is set to go open source.

DECEMBER 15
Releases Skype Translator in beta.

Microsoft's chief experience officer
Julie Larson-Green

ago when he was creating Kinect. In Project HoloLens, Norris saw the potential for technology to help space explorers collaborate more closely and to provide them with a quality known as presence. ("People make better decisions when they feel like they're in the environment," he says.) Last March, Norris and several members of his team relocated from Southern California to Redmond for a few months to build a Mars simulation.

Kipman offers a test drive. WIRED slips on the headset and is transported to the parched, dusty surface of the Red Planet. Behind me, the Curiosity rover towers two metres tall, its cameras recording the terrain. The illusion is leg-quivering realistic, unsure what to make of the disparate information. Norris appears in the Mars-scape, represented as a 3D golden human-shaped blob. A dotted line extends from his eyes toward what he's looking at. "Check that out," he says, and we squat down to see a rock shard up close. Project HoloLens allows users to work on a desktop computer while in the demo, something you can't do in the Rift's virtual world. It also makes it possible to pin holographic flags on the virtual scenario, and someday this will be able to set in motion real-world actions. An upward right-hand gesture brings up a series of controls; choosing the middle of three



options drops a flag. When scientists do this, the command could theoretically be transmitted to the actual rover so that the task can be accomplished in real life, on Mars. The simulation is so effective that Nasa plans to deploy it on a mission by this summer. But this is just one example of Project HoloLens' capabilities. The real opportunity for the platform will come from developers committing resources and imagination to it. Nasa has already signed on as a launch partner; others will likely follow. But for Project HoloLens to succeed – and for Microsoft to succeed – it has to build platforms that developers want to build software for, as it did with Windows for PCs in the 90s, and as it failed to do with Windows for phones earlier in this decade.

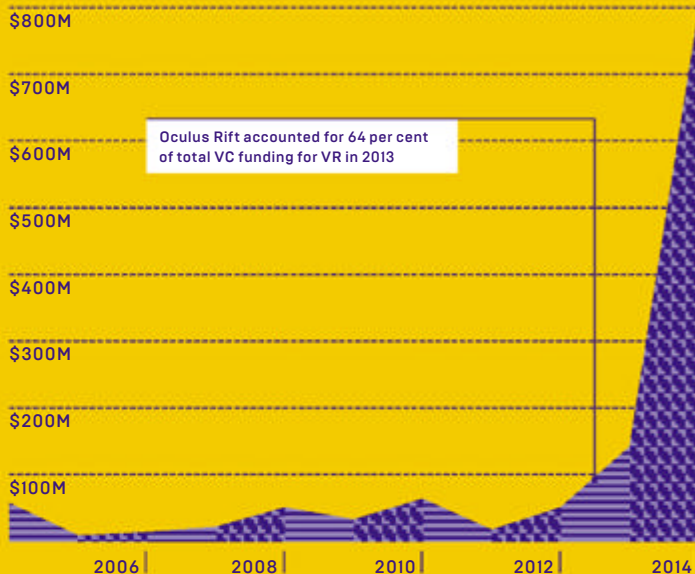
TWO-AND-A-HALF MONTHS

before Microsoft made its Project HoloLens announcement, Nadella is in London to address European customers and developers at an event called Future Decoded. This is the type of audience he'll have to win over if Project HoloLens and future innovations are to succeed. A swing band performed outside an exhibit hall full of Microsoft demos. More than a thousand people crowded into the nearby auditorium for Nadella's appearance, which was advertised as an "intimate, interactive conversation" with a Microsoft UK executive whose title was "chief envisioning officer". The duo promised to cover "how Microsoft is creating the next generation of technology innovation". For all of its promise, the conversation underwhelmed. Nadella kept it to just 15 minutes. His interview was long on catch-phrases ("reinventing productivity" and "mobile first, cloud first") and short on the how. As he exited the stage, a local reporter remarked on his brevity in a tweet: "Whoa! He's gone!" Of course, the point wasn't to say anything new; it was to show face, reinforce Microsoft's message and rebrand the company and its culture as approachable and forward-thinking.

Virtual reality, real money

Venture firms have bet more than \$1 billion that the next big computing platform will emerge from virtual- and augmented-reality projects. JK

VC MONEY INVESTED
IN VR PROJECTS



SOURCE: NATIONAL VENTURE CAPITAL ASSOCIATION AND NEWS REPORTS

The rebranding challenge, in particular, requires consistent reinforcement, and Nadella has been networking at a feverish pace since he started the job. In London he'd started taking customer meetings shortly after 5am that day, and his calendar was packed until well after sundown. (As for why his remarks were so short, the answer was that the conference started later than planned.) Since being named CEO, he's kept up a hefty speaking schedule and met with small groups of journalists over dinner to amplify his efforts. He has relied on board chair John Thompson, who ran securities company Symantec for years and is now CEO of the software company Virtual Instruments, to make introductions for him up and down Silicon Valley's Highway 101. He has spent time meeting with startup founders such as Ryan Smith, who runs Utah-based survey software company Qualtrics and who presented to Nadella at the invitation of venture firm Accel. Nadella asked Smith

a half-dozen questions, quickly picking up on where Smith placed his strongest engineering talent. Smith was impressed. It was his first time meeting with anyone in Redmond. "Historically, companies have struggled a little bit on how to work with Microsoft," Smith says. "I mean, where do you start?" The meeting shifted his impression of the company. "This guy's different," he says of Nadella. "He's humble."

This attitude has helped Nadella forge new partnerships with outfits such as Dropbox and Salesforce. The Salesforce partnership is particularly surprising. For a long time, Microsoft had considered the cloud-computing company an enemy, even launching Dynamics CRM, a direct Salesforce competitor. But Nadella realised that many of Salesforce's customers also used Office 365, and he began wondering if the two products might be combined. So last spring he called up CEO Marc Benioff to propose a partnership. In the first half of 2015,

Salesforce will be integrated with Office, SharePoint, and OneDrive for Business on Android and iOS. A *Salesforce* app for Outlook will also become available and *Salesforce* apps for Windows phones and Excel will follow. Says Benioff: "Before, we just were not able to partner with Microsoft. Satya has opened a door that was closed. And locked. And barricaded."

The new, warm and fuzzy, more collaborative Microsoft has even embraced open source software, the collective multi-authored approach to writing code that Ballmer once referred to as a cancer. In November, Microsoft opened up its entire .NET framework, its programming infrastructure for building and running applications and services.

This new attitude won't necessarily make developers excited about Project HoloLens. But there is optimism in the air. Soon after Microsoft announced that .NET would be open source, Box CEO Aaron Levie summed up the response in a pithy tweet: "Sometimes it feels like Satya is in one of those 80s teen movies when the parents go out of town. And it's great."



S MIND-BLOWING

as a holographic tutorial is, or even the virtual surface of Mars, Project HoloLens' first killer app is likely to be the popular video game *Minecraft*, which Microsoft acquired in September. For a generation of children, *Minecraft* has become the digital equivalent of LEGO, a highly collaborative form of play. Soon, imaginative kids might be able to play in 3D, working alongside holograms of their real-life friends to build things together.

The promise of a product such as this is central to helping Project HoloLens take off. As Terry Myerson, who runs Windows, says, "If you want to play holographic *Minecraft*, the only place to do it is going to be on this." And you don't have to be an early-adopting Glasshole to want in on holographic *Minecraft*.

But you will probably have to wait a little while. Microsoft is being very deliberate in how it rolls out Project HoloLens. First, Nadella plans to spark the public imagination by introducing the device to folks it calls "makers" – the people who attend TED conferences and lined up to buy Google Glass – and the oh-so-critical developers. Microsoft plans to distribute lots of development kits this year. Next up will be the commercial partners. Finally, once the platform has critical mass, Microsoft will make it available to everyone, including the *Minecraft*-obsessed.

The slow roll-out is because – in another sign of an attitude shift – Nadella says he wants to see how people react to Project HoloLens and adjust the product accordingly. In 2007, when Steve Jobs introduced the iPhone, he resisted apps, preferring his customers to access the web through their Safari browsers. But after that approach tanked, in 2008 he released a software development kit and launched the App Store. In similar fashion, Nadella has defined a strategy for Project HoloLens but says its path will ultimately be determined by the behaviours and preferences of its developers and users.

Companies large and small are pushing to invent the next computing interface – a canvas so critical it will be to smartphones what smartphones were to desktop computers. Facebook has Oculus. Google has Glass. And in Dania Beach, Florida, a stealth startup called Magic Leap has banked \$542 million (£360m) in its latest round of funding to develop something allegedly smarter than all of them. The ones that prevail will do so because developers and customers buy into the dream, sinking time and money into their platforms and causing innovation to flourish.

It will take a while for any of these competitors to succeed, and Kipman suggests that if users and developers take Project HoloLens in another direction, or don't take to it at all, Microsoft will be OK. The real beneficiaries of Project HoloLens will be Windows 10; its cloud-computing product, Azure; and its suite of software products, Office 365. They'll continue to improve even if Project HoloLens doesn't. What's far more important is that more people find more ways to use them and, as the next new technology platform emerges – whether it's Project HoloLens or not – Microsoft gets there early.

Just when will the next computing interface take hold? Nadella is not one to predict the future. "What is that quote? I forget now who said this," he says. "You always overestimate what you can get done in a year and underestimate what you can get done in ten years."

WIRED looks up the quote. He got the gist of it right. Who said it? Bill Gates. ■

Jason Kehe is an assistant research editor at US WIRED

**'If you want to play
holographic Minecraft, the only
place to do it is going
to be on Project HoloLens'**

OVERHEARD IN THE WIRED OFFICE THIS MONTH

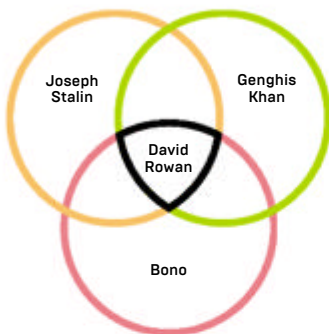
"If you shave a cat, you can still be allergic to it."
"He's a danger to computers."
 "That coffee looks weak.
 I wouldn't give that to a kitten."

TYPEFACES THIS MONTH

Like the font in "Rule breakers" [p86]? Here it is, unfiltered.

**GENETIC TEST REPORTS THIS MONTH**

The results of the WIRED editor's recent 23andMe test only confirmed what we've all long suspected.



Undesirable shared haplogroups aside, he is also more likely to have wet earwax than dry. Shockingly, there is no genetic predisposition for ignoring deadlines in their entirety.

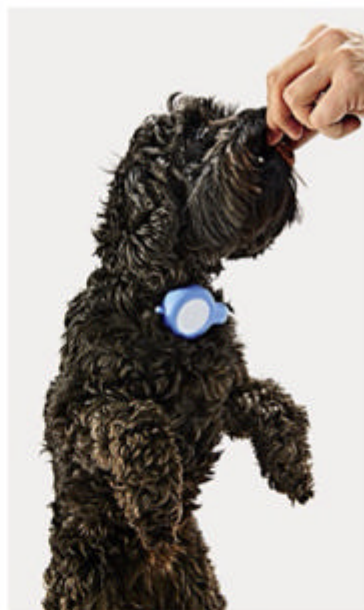
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THANKS TO:

The Idler Academy (idler.co.uk), used in this issue's "Rule breakers" feature

LEAVING WIRED.CO.UK THIS MONTH

We bid a geek farewell to Nate Lanxon, editor of wired.co.uk – the internet just won't be the same...



Woody the cockerpool (left) modelled the pet trackers tested in Gear. For an hour he posed impeccably – thanks to a steady stream of Gravy Bites. However, the constant pop of the flashbulb and a belly full of snacks made him lie down and refuse to budge. His subsequent sluggishness means he's unlikely to require a tracking device of his own any time soon.

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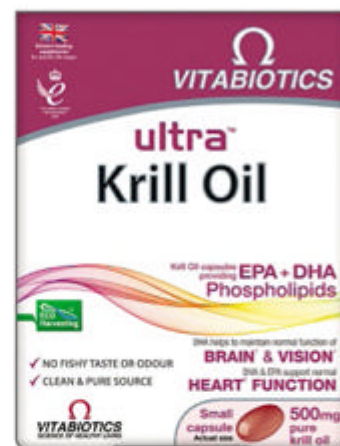
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DATA CLUTTERING OUR INBOXES THIS MONTH

\$6.5 MILLION

Amount *Phantom*, Peter Lik's black-and-white photograph of Arizona's Antelope Canyon, sold for in November 2014, making it the most expensive photo ever

13.8BN

The time, in years, it would take the optical-lattice clock, built by researchers at the Joint Institute for Astrophysics in Colorado, to lose one second

TWELVE

Period of time, in hours, humans should limit food consumption within each day in order to lose weight without changing diet, according to the Salk Institute

\$43.4m

The in-app revenue that Kim Kardashian's free mobile app, *Kim Kardashian: Hollywood*, made in the third quarter of 2014

TEN PER CENT

The amount a strawberry mousse was considered sweeter when served on a white plate rather than a black one in research at Universitat Politècnica de València

100%

Proportion of people who earn more than \$500K to say they were "very happy" in a University of Michigan study

70%

Percentage of \$150K – \$250K earners who said they were "very happy"

46%

Percentage of \$40K – \$50K earners who said they were "very happy"

35%

Percentage of people who earn less than \$10K to say they were "very happy"



43%

Proportion of British pilots who admitted in a survey involuntarily falling asleep while in the cockpit

33%

Proportion of the surveyed pilots who woke up to find their co-pilot had also fallen asleep in the cockpit

4,680

Number of women who underwent breast-reduction surgery in the UK in 2013

796

UK men who underwent the same procedure in 2013

53 x 76 x 76

The size of the box, in centimetres, in which terror suspect Abu Zubaydah was kept for 29 hours while under CIA detention during 2002

9,223,372,036,854,775,808

Total number of video views YouTube's counter is programmed to handle

2,147,483,647

The original number, before the success of Psy's "Gangnam Style" forced a reprogram





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